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ABSTRACT

This final report of the Group Errorless Teaching Strategies Research Project is organized by the project objectives and covers planned and actual activities and outcomes. Objective 1 involved a review of the literature related to teaching students with mild and moderate mental handicaps in group settings and resulted in three articles which presented guidelines for implementing group instruction and the use of constant time delay in group instruction. Objectives 2 and 3 involved conducting four investigations per year to evaluate the effectiveness and efficiency of the system of least prompts and time delay in small group instructional arrangements. Emphasis was on how to conduct small group instruction and effects of various attentional cue manipulations in small groups. Objective 4 involved developing instructional modules and manuals, which were sent to selected training programs and agencies. The primary part of the document consists of 15 appendixes, including the texts of journal articles disseminated by the project, unpublished manuscripts, and four instructional manuals and modules. The journal articles and manuscripts discuss such topics as: small group instruction; constant time delay to teach chained tasks and to teach sight word reading; predictable and unpredictable trial sequences; use of choral and individual spelling attentional responses in teaching sight word reading; use of the system of least prompts; and acquisition of incidental information. The instructional manuals and modules cover small group instruction for students with moderate to severe disabilities, and the use of constant time delay in small group instruction. (DB)

FINAL REPORT

Group Errorless Teaching Strategies (GETS)

Grant Number: G008730215

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[1] This report was prepared by Drs. David L. Gast and Mark Wolery on July 23-24, 1990.

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Introduction

This final report of the Group Errorless Teaching Strategies (GETS) Research Project is organized by the objectives of the project. For each objective, the objective, planned activities, expected outcomes, and actual activities and outcomes are listed.

Objective 1 involved a review of the literature related to teaching students with mild and moderate mental handicaps in group settings. This review was completed and written. Three articles were developed based on the literature review. One article focused on guidelines for implementing group instruction. A second article focused on procedures for measuring chained tasks using constant time delay. A third article describing the use of constant time delay in groups has been written, and will be revised for submission. These are described in the narrative of the final report and the completed documents are included in the Appendix.

Objectives 2 and 3 involved conducting four investigations per year that evaluated the effectiveness and efficiency of the system of least prompts and time delay in small group instructional arrangements. These investigations were planned, conducted, and described in manuscripts that have been published and others are in the process of being published. Based on the findings of the literature review and the first and second year investigations, the nature of the comparative investigations focused more on analysis of how to conduct small group instruction and effects of various attentional cue manipulations in small groups rather than comparisons of the prompting strategies used (i.e., system of least prompts and time delay). A description of each is included in the narrative of the final report, and the complete documents are included in the Appendix. A total of 15 separate experiments were conducted and were described in 11 articles. Two of the articles each contain descriptions of three experiments.

Objective 4 involved developing instructional modules and manuals. Two manuals were were planned and completed. One manual presents guidelines for conducting small group instruction with students who display mild and moderate handicaps. Some of the information from this manual was included in an article that is in press from the literature review. The second manual describes procedures for using time delay in small group instructional arrangements. One instructional module for each manual has been developed. The manuals and modules have been sent to selected training programs and educational agencies.

OBJECTIVE 1

This section of the final report lists the first GETS Project objective, major activities used to meet Objective 1, expected outcomes of Objective 1, and description of completed activities and actual outcomes for Objective 1.

OBJECTIVE 1:

To conduct a thorough review of the applied research literature that will result in a written product describing the instructional practices in small group instructional arrangements involving students with mild and moderate handicaps in applied settings.

PLANNED ACTIVITIES FOR OBJECTIVE 1.

1. Conduct literature review
2. Based on the literature review, develop and write recommendations for teachers of students with mild and moderate learning difficulties
3. Based on the literature review, develop and write research questions for further research
4. Advisory Committee reviews document
5. Make final revisions of document
6. Submit document or parts of document for publication in professional journals
7. Notify teacher preparation programs through Special Net that the document is available

EXPECTED OUTCOMES FOR OBJECTIVE 1.

The major expected outcome of the first objective is a written document that reviews the applied research literature related to errorless learning in group instructional arrangements with students who have mild to severe learning difficulties. The review will describe the instructional procedures that have been used, the effects of such use, group management strategies, teacher skills needed to implement the procedures, and where possible, recommendations for future use. The effects will be analyzed in terms of effectiveness variables, efficiency variables, and generalization outcomes. This information will result in a document that establishes what is currently known about effective and efficient group instructional procedures with students who have mild to severe handicaps. The document will have potential impact for both practitioners, teacher trainers, and persons engaged primarily in research. The impact for teachers and other practitioners will be in the recommendations that come from the reviewed literature. The impact for persons engaged in research will be in the specification of future research issues.

ACTUAL ACTIVITIES AND OUTCOMES FOR OBJECTIVE 1.

1. Conduct literature review. - The two Research Associates, Melinda Jones Ault and Patricia Munson Doyle, and the Principal Investigator, Dr. David Gast, and two doctoral students, Vincent Winterling and Belva Collins reviewed the literature from professional journals for articles that addressed teaching students with handicaps in small group arrangements. The reference lists of these articles were also analyzed to identify any other articles that may be relevant to the topic and published in other journals. A matrix describing the purpose, methodology, and findings of each identified investigation was developed.

2. Develop recommendations for teaching in small group arrangements. The two Research Associates, two doctoral students, and the Principal Investigator were assigned to specific responsibilities for developing recommendations from the described literature. One Research Associate and one doctoral student under the supervision of the Principal Investigator developed a list of general guidelines for implementing small group instruction. These recommendations were incorporated into an article on general guidelines. The second Research Associate and doctoral student under the supervision of the Principal Investigator developed a list of recommendations for using time delay in group instructional arrangements. An article describing these recommendations has been developed. The two Research Associates, Co-Principal Investigator, and Principal Investigator developed recommendations for collecting data on the time delay procedure when teaching chained tasks. An article incorporating these recommendations was developed.

3. Develop a list of research questions related to conducting small group instruction. A list of suggested research questions were developed. These were incorporated into the articles described above and were also included as suggestions in the discussion sections of articles based on the investigations conducted by the project.

4. Advisory board reviews articles. The instructional research team which consisted of the Principal Investigator, Co-Principal Investigator, GETS Research Associates, Research Associates on other research projects, and other faculty members of the Department of Special Education, and selected doctoral students served as the Advisory Board. These individuals reviewed the articles that were prepared for publication and provided feedback to the research staff.

5. Make revisions in final documents. Based on the review of the individuals identified above, revisions were made in the documents.

6. Submit the documents for publication in the professional literature. Three articles were written and two of these have been submitted for publication. The article describing general guideilnes (Collins, Gast, Ault, & Wolery, in press) was submitted and accepted for publication by Education and Training in Mental Retardation. This article is included in Appendix A. The article describing data collection procedures for time delay with chained tasks (Ault, Gast, Wolery, & Doyle, in press) was submitted and accepted for

publication by Teaching Exceptional Children. This article is presented in Appendix B. The third article on using time delay in small group arrangements is being revised and will be submitted for publication. This article is presented in Appendix C.

7. Notify personnel preparation programs of the documents. Dissemination involved sending a copy of the literature review to persons on the mailing list of the GETS Project.

OBJECTIVE 2 and 3

This section of the final report lists the second GETS Project Objective, planned activities for meeting Objective 2 and 3, expected outcomes of Objective 2 and 3, and actual activities and outcomes of Objective 2 and 3. The "actual outcomes" section includes an abstract of each investigation. The activities and outcomes are presented separately for each project year.

OBJECTIVES 2 and 3

To conduct and report on eight investigations (four per year for the first two years) analyzing the effectiveness and efficiency of the system of least prompts and time delay in group settings for teaching functional skills to primary and secondary aged students with mild and moderate handicaps.

~~To conduct and report on four investigations (third project year) that compare the effectiveness and efficiency of the system of least prompts and time delay in teaching functional skills to primary and secondary aged students with mild and moderate handicaps.~~ ok

PLANNED ACTIVITIES FOR OBJECTIVES 2 and 3.

Each Project Year

1. Determine which four studies will be conducted during the project year.
2. Identify five subjects for each study.
3. Secure human subjects review approval from University of Kentucky and participating agencies.
4. Secure informed consent from parents of subjects.
5. Implement and monitor investigations.
6. Conduct ongoing analysis of the data.
7. Analyze final results.
8. Write reports of studies for dissemination in professional literature.

EXPECTED OUTCOMES FOR OBJECTIVE 2 AND 3

The expected outcomes of the second and third objectives are written reports on the results of the twelve studies. These reports will be submitted to appropriate professional journals. Presentations at state, regional, and national conferences will also occur.

ACTUAL ACTIVITIES AND OUTCOMES FOR OBJECTIVE 2 AND 3

Over the course of the three project years, 15 investigations were conducted and described in 11 reports. To date, three articles have been published, four articles have been accepted and are in press, one has been submitted for publication, and three are in the process of being written and submitted.

Summaries of Investigations

Study # 1: Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Farmer, J. A. (1990). Use of constant time delay in small group instruction: A study of observational and incidental learning. Journal of Special Education, 23, 369-385.

This investigation examined the effectiveness and efficiency of constant time delay in small group instruction. Four secondary-age students with mild and moderate mental retardation were taught to identify local and federal services and government agencies and over-the-counter medications. The amount of information learned when each subject was presented with two target and six observational stimuli (same-task, different-stimuli condition) was compared to when each student in the group was taught the same eight target stimuli (same-task, same-stimuli condition). The subjects' acquisition of incidental information presented in the descriptive praise statement following correct responses to the target stimuli was assessed. A multiple probe design across behaviors was used. The results indicated that (a) constant time delay was effective across all facts, students, and conditions; (b) the same-task, different-stimuli condition produced more efficient learning than the same-task, same-stimuli condition; (c) students acquired more target information in the same-task, same-stimuli conditions; (d) observational learning occurred in the same-task, different stimuli condition for all subjects; (e) increased exposure to other students' target information and differential reinforcement in the probe conditions increased the percentages of correct observational responding in the same-task, different-stimuli conditions; and (f) there were not differences between conditions in students' acquisition of incidental information. These findings are discussed in terms of strategies for designing effective and efficient small group instruction. A reprint of this article is found in Appendix D.

Study # 2: Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Martin, C. P. (1990). Comparison of predictable and unpredictable trial sequences during small group instruction. Learning Disability Quarterly, 13, 12-29.

The use of predictable (round robin) and unpredictable (random) trial sequences during small-group instruction was evaluated in three experiments in teaching word and abbreviation identification to four students with learning disabilities; a fifth student participated in part of Experiment I before moving to another school. In Experiment I, a progressive time delay procedure was used to teach word-reading in a small group, and the effects of a single-trial, predictable sequence was compared to a single-trial, unpredictable sequence. In Experiment II, a progressive time delay procedure also was used to teach abbreviation identification in a small group, and the effects of a multiple-trial, predictable sequences was compared to a multiple-trial, unpredictable sequence. In Experiment III, a model-test procedure was used in a small group, and the effects of the multiple-trial predictable sequence was compared to the single-trial, unpredictable sequence. An adapted alternating treatments design was used in all experiments. Results indicate that the progressive time delay procedure was reliably implemented and was effective in establishing criterion-level responding by all group members. Students also learned words taught to other students through observation. In Experiment I, the two trial sequences did not differ substantially, and in Experiment II mixed effects were found. With the model-test procedure in Experiment III, two students initially produced higher levels of correct responding in the multiple-trial, predictable sequence; however, no substantial differences were found in observational learning. Across all investigations, no consistent effects of the trial presentation methods were noted. A reprint of this article is found in Appendix E.

Study # 3: Gast, D. L., Wolery, M., Morris, L. L., Doyle, P. M., & Meyer, S. (1990). Teaching sight word reading in a group instructional arrangement using constant time delay. Exceptionality, 1, 81-96.

In this investigation we examined the effectiveness of constant time delay (CTD) in a small group instructional arrangement. Five primary-aged students in a self-contained classroom for students with moderate delays were taught to read environmental sight words. In addition, we assessed observational learning (students learning other group members' words) across each instructional condition. The definitions of the words taught were inserted in the descriptive verbal praise statement after correct responses. We assessed students on their acquisition of definitions of their target and observational learning words. We used a multiple probe design across words sets to assess the effectiveness of the CTD procedure in the small group instructional arrangement. The results indicate that (a) CTD was effective in teaching sight words to four students, (b) students acquired some information targeted for other students, and (c) students acquired a minimal amount of information presented in the praise statements for their own and other group members' target behaviors. A reprint of this article is presented in Appendix F.

Study # 4: Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (in press). Acquisition of incidental information during small group instrution. Education and Treatment of Children.

This investigation examined the effectiveness of a constant time delay procedure in a small group instructional arrangement. Four primary-aged students with mild handicaps were taught to read sight words representing objects found in their environment. In addition, the students' acquisition of incidental information, the correct spelling of each sight words, was assessed. The teacher presented the spelling of the target word either prior to the student reading the word, or as part of the consequent event, following a student's response. A multiple probe design across word sets was used to assess effectiveness of the constant time delay procedure. The results indicated that: (a) constant time delay was effective in teaching all words to each of the four students; and (b) each student acquired some of the non-targeted spelling information. The findings are discussed in terms of designing effective and efficient small group instruction for students with disabilities. This paper is included in Appendix G.

Study # 5: Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Griffen, A. K. (in press a). Teaching chained tasks in dyads: Acquisition of target and observational behaviors. Journal of Special Education.

This investigation used a multiple probe design to evaluate the use of a constant time delay procedure in a small group instructional arrangement. Two pairs of two students (i.e. dyads) with moderate mental retardation were taught domestic and vocational chained tasks. Tasks for each dyad were divided so that one student of the dyad was taught the first part of the task, and the other student was taught the second part. Interactions between members of each dyad were specifically prompted so that students delivered both antecedent (i.e., attentional cue), and consequent (i.e., reinforcement) events to their dyad member. Students observed each other learning their respective part of the task and then were assessed on their ability to perform both parts of the task (i.e., the part taught directly and the part taught to the other member of the dyad). The results indicate that (a) constant time delay was effective in teaching chained tasks in dyads, and (b) all students learned a substantial amount of the tasks they were not directly taught but that they observed being taught to other members of their dyad. These findings are discussed in terms of designing effective and efficient instruction for students with moderate handicaps. This paper is included in Appendix H.

<u>Study # 6</u>: Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Mills, B. M. (in press). Use of choral and individual spelling attentional responses in teaching sight word reading during small group instruction. <u>Remedial and Special Education</u>.

This study evaluated using choral and individual attentional responses with a constant time delay procedure when teaching students with mild handicaps to read sight words. Each student learned a different set of words; a choral spelling attentional response (i.e., all students simultaneously spelled the word before the target student read it) was used with half of the words, and an individual spelling attentional response (i.e., only the target student spelled the word before reading it) was used with the other half. Constant time delay as used to teach all words. Students were assessed on reading their words, reading others' words, (i.e., observational learning), and spelling all words (i.e., incidental learning). A multiple probe design across behaviors was used to evaluate the procedures. The results indicate that (a) constant time delay was implemented reliably and was effective in teaching word reading with minimal errors, (b) words taught with an individual spelling attentional response were learned in fewer sessions and lower error percentages, (c) observational and incidental learning occurred for all students, d) choral and individual attentional responses did not influence observational word reading, (e) spelling was greater on others' words when a choral attentional response was used. This paper is included in Appendix I.

<u>Study # 7</u>: Wolery, M., Cybriwsky, C., Gast, D. L., & Boyle-Gast, K. (in press). General and specific attentional responses: Acquisition and maintenance of target, observational, and related nontarget facts. <u>Exceptional Children</u>.

This study investigated the effects of constant time delay (an errorless learning procedure) in small-group instruction with adolescents who have learning or behavior disorders. Two attentional responses (specific and general) were used, and two types of praise were employed, one which included additional tasks information and one that only provided general praise. Students were taught four sets of information and each of the attentional responses and praise forms were present in each set. Measures were taken on students' performance on target behaviors, observational behaviors (target behaviors for other group members), incidental learning (information provided in descriptive praise statements), and observational-incidental learning (information provided in praise statements for other group members). The results indicate that (a) constant time delay was reliably implemented and was effective in establishing criterion level performance, (b) students acquired targeted behaviors with minimal errors, (c) students acquired some behaviors targeted for other students, (d) students acquired some information presented in praise statements for their target behaviors, (e) students acquired some information presented in praise statements for other members, (f) specific attentional responses facilitated maintenance of observational learning, and (g) specific attentional responses facilitated acquisition of incidental information. This paper is included in Appendix J.

<u>Study # 8</u>: Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Meyer, S. (1989). <u>The effective use of the system of least prompts in a small group instructional arrangement</u>. Manuscript submitted for publication.

This investigation examined the effectiveness and efficiency of a system of least prompts procedure in a small group instructional arrangement. Four primary-aged students in a self-contained public school classroom for students with moderate handicaps were taught to read food words found on restaurant menus. In addition, students' acquisition of incidental information (i.e., the approximate cost of the food and at what meal the food is normally consumed) was assessed across each instructional condition. The incidental information was presented in the instructional procedure's prompt hierarchy during instruction. A multiple probe design across word sets was used to assess the effectiveness of the system of least prompts procedures in the small group instructional arrangement. The results indicated that: (a) the system of least prompts procedure was effective in teaching food words to teach of the four students in a small group instructional arrangement; and (b) each student acquired some of the non-target incidental information. The results are discussed in terms of designing efficient small group instructional arrangements while using effective instructional strategies. This paper is presented in Appendix K.

<u>Study # 9</u>: Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (1990). <u>Acquisition of incidental information presented in consequent events</u>. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

This investigation examined the effects of presenting incidental information in the consequent events following student responses to target stimuli. Four primary-aged students from a classroom for students with multiple handicaps were taught to name photographs of buildings and places of interest in the local community using a constant time delay procedure. In addition, the students' acquisition of incidental information related to each of the photographs was assessed. The incidental stimuli included the street address and/or an activity conducted at the building or place. The teacher presented the incidental stimuli as part of the consequent event following a student's response during instructional conditions. A multiple probe design was used to assess experimental control of both acquisition of target and incidental stimuli. The results indicated that: (a) three students learned to name 12 photographs and one student learned to name three photographs; (b) presentation of incidental stimuli in the consequent events resulted in three students acquiring some of the non-targeted incidental information; and (c) the type and amount of incidental stimuli learned was consistent across participants. These findings are discussed in terms of designing efficient instruction for students with disabilities. A copy of this article is presented Appendix L.

Study # 10: Wolery, M., Ault, M. J., Doyle, P. M., Gast, D. L., & Griffen, A. K. (1990). Choral and individual responding in small groups by students with moderate mental retardation. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Three investigations examined the effects of two methods of trial presentation: choral responding and individual responding in teaching four students with moderate mental retardation in a small group instructional arrangement. The research question was which of the two trial presentation methods resulted in more rapid learning. In Experiment I, the number of exposures to target stimuli were equal across the two conditions, and the opportunities to respond were unequal. Students were taught eight community-sign words with the model-test procedure, and the percent of correct responding across daily probes was the dependent measure. In Experiment II, the number of opportunities to respond were equal across the two conditions, and the number of trials were unequal. In Experiment III, the most efficient conditions in both Experiment I and Experiment II were compared. The results indicated that (a) in Experiment I, the choral responding condition was more efficient for two subjects and equal for two subjects; (b) in Experiment II, the individual responding condition was more effective, and the efficiency of the two procedures was mixed depending upon the measure used; and (c) in Experiment III, the two procedures were essentially equal. A copy of this article is presented Appendix M.

Study # 11: Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Meyer, S. (1990). Comparison of specific and general attentional responses during small group instruction. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

The use of a specific and general attending response was evaluated in teaching discrete tasks to 4 students with moderate mental retardation. Students were taught discrete tasks (i.e., safety symbol identification, numeral identification, and photograph identification) using a constant time delay procedure in a small group instructional format. A specific attending response condition in which students were required to match the target stimulus before responding, was compared with a general attending response condition in which students were required to simply look at the stimulus before responding. An adapted alternating treatments design was used to compare the conditions. The results indicated that the constant time delay procedure using both the specific and general attending response conditions were effective in teaching discrete tasks to all students. Efficiency data in terms of sessions, errors, and instructional time to criterion were compared. The general condition was more efficient in terms of sessions to criterion for 3 of the 4 subjects with the specific condition being slightly more efficient for the fourth. The two conditions were essentially equal in terms of percent of errors to criterion for all subjects. The general condition resulted in less direct instructional time for the group because of the additional time required to perform the specific attending response. Observational learning (i.e., students' ability to identify other students' target stimuli) was also measured. Results indicated that 3 of the 4 students learned more stimuli that were taught in the specific attending response condition while 1 student learned more of the stimuli taught in the general attending response condition. A copy of this article is presented in Appendix N.

Presentations of GETS Research

During the three project years, presentations were made at state and national conferences. These included the Association for Behavior Analysis, Association for Persons with Severe Handicaps, State Council for Exceptional Children Meetings, and various presentations sponsored by State and Local Educational Agencies. This content was included in graduate seminars conducted by the Principal Investigator.

OBJECTIVE 4

This section of the final report lists the fourth GETS Project Objective, planned activities for meeting Objective 4, expected outcomes of Objective 4, and actual activities and outcomes of Objective 4.

OBJECTIVE 4

To develop two manuals and two instructional modules that describe how to use (a) the system of least prompts in a group setting, and (b) the time delay procedure in group settings.

PLANNED ACTIVITIES FOR OBJECTIVE 4:

The purpose of this objective is to develop documents that will allow the results of the proposed investigations to be quickly disseminated to teachers and other practitioners who need the information. Research reports based on the investigations will be prepared and submitted to appropriate outlets in the professional literature. This activity will continue during the three project years. In addition, two "how-to" manuals will be developed during the second and third project years. Each of these manuals will describe one of the two instructional procedures and their use in group situation. Teachers and other practitioners will be the primary dissemination audience for the manuals. Two instructional modules describing the procedures and how to use them will also be written during the second and third project years. Personnel involved in teacher preparation will be the primary dissemination audience for the instructional modules. Each manual will be reviewed by the Advisory Committee and made available to the respective audiences.

EXPECTED OUTCOMES FOR OBJECTIVE 4

The expected outcomes of Objective 4 are (a) two manuals describing the use of the two instructional procedures in group instruction which include recommendations based on the proposed research and the literature review, (b) two instructional modules describing the instructional procedures and how to use them in group arrangements for dissemination to teacher trainers.

ACTUAL ACTIVITIES AND OUTCOMES FOR OBJECTIVE 4

Four products were developed from Objective 4, two manuals and two instructional modules. One manual addresses guidelines for conducting small group instruction which includes a current review of small group instructional research with students displaying disabilities. The second manual describes procedures for using the constant time delay in teaching students in small group instructional arrangements. One instructional modules was written for each manual. These are presented in Appendix 0.

List of Appendices

Appendix A

Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (in press). Small group instruction: Guidelines for teachers of students with moderate to severe handicaps. Education and Training in Mental Retardation.

Appendix B

Ault, M. J., Gast, D. L., Wolery, M., & Doyle, P. M. (in press). A data collection and graphing methods for use in teaching chained tasks with the constant time delay procedure. Teaching Exceptional Children.

Appendix C

Winterling, V., Gast, D. L., Doyle, P. M., Wolery, M. (1990). Effective and efficient small group instruction: The use of constant time delay. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Appendix D

Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Farmer, J. A. (1990). Use of constant time delay in small group instruction: A study of observational and incidental learning. Journal of Special Education, 23, 369-385.

Appendix .

Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Martin, C. P. (1990). Comparison of predictable and unpredictable trial sequences during small group instruction. Learning Disability Quarterly, 13, 12-29.

Appendix F

Gast, D. L., Wolery, M., Morris, L. L., Doyle, P. M., & Meyer, S. (1990). Teaching sight word reading in a group instructional arrangement using constant time delay. Exceptionality, 1, 81-96.

Appendix G

Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (in press). Acquisition of incidental information during small group instruction. Education and Treatment of Children.

Appendix H

Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Griffen, A. K. (in press a). Teaching chained tasks in dyads: Acquisition of target and observational behaviors. Journal of Special Education.

Appendix I

Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Mills, B. M. (in press). Use of choral and individual spelling attentional responses in teaching sight word reading during small group instruction. Remedial and Special Education.

Appendix J

Wolery, M., Cybriwsky, C., Gast, D. L., & Boyle-Gast, K. (in press). General and specific attentional responses: Acquisition and maintenance of target, observational, and related nontarget facts. Exceptional Children.

Appendix K

Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Meyer, S. (1989). The effective use of the system of least prompts in a small group instructional arrangement. Manuscript submitted for publication.

Appendix L

Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (1990). Acquisition of incidental information presented in consequent events. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Appendix M

Wolery, M., Ault, M. J., Doyle, P. M., Gast, D. L., & Griffen, A. K. (1990). Choral and individual responding in small groups by students with moderate mental retardation. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Appendix N

Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Meyer, S. (1990). Comparison of specific and general attentional responses during small group instruction. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Appendix O

Instructional Manuals and Modules:

Doyle, P. M., Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (1990). Module: Small group instruction: Guidelines for teachers with moderate to severe disabilities. Unpublished Instructional Module, Lexington, KY: Department of Special Education, University of Kentucky.

Doyle, P. M., Winterling, V., Gast, D. L., & Wolery, M. (1990). Module: Effective and efficient small group instruction: The use of constant time delay. Unpublished Instructional Module, Lexington, KY: Department of Special Education, University of Kentucky.

Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (1990). Small group instruction: Guidelines for teachers of students with moderate to severe handicaps. Unpublished Instructional Manual, Lexington, KY: Department of Special Education, University of Kentucky.

Winterling, V., Gast, D. L., Doyle, P. M., & Wolery, M. (1990). Effective and efficient small group instruction: The use of constant time delay. Unpublished Instructional Manual, Lexington, KY: Department of Special Education, University of Kentucky.

Appendix A

Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (in press). Small group instruction: Guidelines for teachers of students with moderate to severe handicaps. Education and Training in Mental Retardation.

Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps [1]

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Running Head: GUIDELINES FOR GROUP INSTRUCTION

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Abstract

This article reviews the current research literature on small group instruction with students who have moderate to severe handicaps. Several components of small group instruction are identified and defined, and research examples are provided for each. The components are discussed in terms of recommendations for teachers when designing small group instruction. Future research needs are also identified.

Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps

Traditionally, students with moderate to severe handicaps have been taught in 1:1 instructional arrangements. Whether this is the most effective and efficient way to teach these students has not been validated. A viable alternative to 1:1 instruction is teaching in small groups. Group instruction may actually be more advantageous than 1:1 instruction because (a) teachers can instruct more than one student at a time, (b) less classroom personnel and instructional time is required, (c) students may be prepared to function in less restrictive environments which frequently use group arrangements (Fink & Sandall, 1978), (d) students may learn to interact appropriately with peers (Alberto, Jobes, Sizemore, & Doran, 1980), and (e) students may learn additional information from observing other members of the group (Westling, Ferrell, & Swenson, 1982). For our purposes, small group instruction is defined as at least 2 and no more than 10 students being taught by 1 instructor.

To make recommendations on how small groups should be designed, the current literature was reviewed and studies conducted at the University of Kentucky were examined. The literature reviewed focused on acquisition studies which involved students with moderate to severe handicaps. From this literature, a number of components were identified that should be considered when designing small group instructional programs (Collins & Gast, 1988). The body of research has not examined all of these components satisfactorily and sufficient investigations have not been conducted to determine the best way to facilitate acquisition in small groups. Therefore, the purpose of this manuscript is to inform teachers of students with moderate to severe handicaps about decisions that need to be made when developing small group instructional programs. A secondary purpose is to provide recommendations pertaining to each of these decisions. The following questions address the components of small group instruction that should be considered by teachers.

How Will Groups Be Composed?

Some of the first decisions teachers must make when designing small group instruction relate to the composition of the group. The teacher must consider what students will be in the group, how many students will be taught, what tasks will be taught, and how group members will interact.

Group size. The size of the group is one of the first decisions that teachers need to make. Of the studies reviewed, the maximum number of students taught in a small group was 7 (Winkler, Arnold, & Russell, 1987). However, most investigations included 2-4 students (Alberto et al., 1980; Brown & Holvoet, 1982; Favell, Favell, & McCimsey, 1978; Faw, Reid, Schepis, Fitzgerald, & Welty, 1981; Frankosky & Sulzer-Azaroff, 1978). The teacher, when making a decision on the number of students to include in a group, should consider the following variables: (a) the handicapping conditions of the students; (b) the students' experience in group settings; (c) the students' command of appropriate group skills, (i.e., ability to sit and attend, appropriate social skills); (d) the type of task to be taught; and (e) session length. For example, students with more severe handicaps, may have limited experience in groups, may not be able to sit for long periods of time, may not possess the necessary social skills (e.g., standing or sitting in close proximity to others, turn-taking, compliance) and may have longer responding times. In such cases, the teacher may want to involve a smaller number of students in the group to shorten session length and to instruct all members of the group adequately. On the other hand, students who have some group experience and possess the necessary prerequisite skills may be able to function as a member of a larger group.

Homogeneous/heterogeneous groupings. Based on the student population of the classroom and the tasks identified to be taught, the teacher must decide if homogeneous or heterogeneous groupings will be used. For the purpose of this manuscript, homogeneous groupings were defined as groups containing students with the same diagnostic label and/or with an age span of no more than 2 chronological years; heterogeneous groupings were defined as groups containing students who function at different levels and/or have age spans of greater than 2 chronological years. For example, Alberto et al. (1980) taught self-help and language skills to students who all had severe handicaps and who ranged in age from 6-8 years, while Favell et al. (1978) taught word recognition to students whose ages ranged from 9-25 years and whose disabilities ranged from moderate to profound levels. An advantage of homogeneous groupings for the teacher may be the ease with which the group is conducted since it is more likely that all students in the group will learn the same type of task and will have the same skill level. However, identifying a group of students that are similar in age and handicapping conditions may be difficult and unrealistic, especially if students participate in groups in least restrictive or community settings. Conducting a group with a heterogeneous population may be more difficult since students will probably be learning a variety of skills, but students may have a greater opportunity to learn additional information by observing the other group members.

Task selection. Students in the group may all be working on the same type of task using either the same stimuli or different stimuli. Alternatively, each student in the group may be learning a different type of task, again with either the same stimuli or different stimuli. An example of "same task, same stimuli" was used by Doyle, Gast, Wolery, Ault, and Meyer (1989) when they taught all students in the group to read the same words off a menu from the community. Kohl (1981) used a "same task, different stimuli" format when each student in a group was taught to manually sign different stimuli. "Different task, same stimuli" was used by Horst, Wehman, Hill, and Bailey (1981) in teaching leisure skills to adolescents with severe handicaps; each student in the group learned to perform a different leisure skill with the same stimuli, a frisbee. Finally, Brown and Holvoet (1982) used a "different task, different stimuli" format in teaching clerical skills to students with profound mental retardation; each student learned a different clerical skill using different materials. Obviously, the needs of the group should be assessed to determine what tasks will be taught. When different tasks or stimuli are used, students have the potential to learn what is being taught to other members of the group (Wolery, Ault, Gast, Doyle, & Mills, 1989). This is not possible when all members of the group are using the same stimuli. The teacher should realize that teaching the same task or same stimuli to group members increases the ease with which the group is conducted and may affect how quickly students learn.

<u>Entry criteria</u>. When choosing students to be members of the group the teacher should ensure that each member has the skills necessary for successful participation. These might include appropriate social behaviors (Marchetti, Cecil, Graves, & Marchetti, 1984), eye contact with the teacher and stimuli (Alberto et al., 1980), compliance to task requests (Faw et al., 1981), and minimal performance on skills to be taught (MacDonald, Dixon, & LeBlanc, 1986). It is important for the teacher to identify prerequisite skills needed for the task to be taught and for inclusion in a group, and then to assess these skills before beginning the group. Failure to do so may adversely influence the performance of other group members. Some students may need to be taught some prerequisite skills before becoming a group member.

<u>Group arrangements</u>. Groups may be organized in four different ways; intrasequential, intersequential, tandem, and 1:1 supplement (Brown, Holvoet, Guess, & Mulligan, 1980). First, in an intrasequential group arrangement, the teacher provides instruction to each member individually within the group setting without structuring any interaction between group members. For example, Wilson, Cuvo, and Davis (1986) taught meal planning skills to students with multiple disabilities. The teacher modeled for the entire group and then gave feedback to each individual student. Second, in an intersequential group arrangement, the teacher provides instruction and specifically structures or reinforces interactions between group members. Wolery, Ault, Gast, Doyle, and Griffen (1989) taught chained tasks to students with moderate handicaps in dyads. Students were prompted to provide attentional cues and reinforcement to each other. Third, in a tandem group arrangement, the teacher begins instruction in a 1:1 format and

systematically increases the group size. Koegel and Rincover (1974) used a tandem group arrangement in teaching language skills to students with autism. Initially, two students were present in the group and the teacher systematically increased the group size until 8 members were present. And fourth, when a 1:1 supplement is used, the teacher provides instruction in one of the above group arrangements and then conducts 1:1 sessions to provide extra practice on the skill. A 1:1 supplement arrangement was used by Faw et al. (1981) in teaching manual signing to students with profound handicaps. Instruction occurred in a group, and students received 1:1 instruction when incorrect responses occurred during the group session. No comparisons of these types of group arrangements appear in the literature; thus, no empirically based recommendations exist for guiding the teacher in choosing the most effective and efficient arrangement. However, each has its advantages. An intrasequential group arrangement is the least complex type of arrangement and, therefore, it may be used with ease by teachers or teaching assistants who may be inexperienced in conducting group instruction. The use of an intersequential group arrangement would be useful for teachers who have a heterogeneous group population since peer tutoring interactions can be specifically structured. In addition, this arrangement may facilitate attention to task since group members are interacting with others in the group as well as being instructed on their own stimuli. The tandem group arrangement is ideal for teachers who have students who do not have the prerequisite skills to participate in a group or for students who are unfamiliar with group instruction. By using the tandem arrangement, the teacher can form successful groups by systematically increasing the size of the group as students develop the necessary skills. The 1:1 supplement arrangement provides the teacher with increased flexibility since 1:1 instruction can be provided in addition to group instruction for those students who do not learn or whose learning is inefficient in a group.

Criteria for conducting a session. After teachers have made all of the decisions concerning group composition, they must establish the criteria of attendance to be used to hold the session. In other words, the teacher should decide how many of the students in the group should be present to conduct the instructional session. This decision is important for teachers but critical for researchers who are studying the efficacy of small group instruction, particularly if observational learning is under investigation (Bandura, 1971). For the teacher this is an arbitrary one that should be made prior to beginning instruction. If the teacher decides that all students must be present before the group will be held, then it is possible that many days may elapse without instruction for those students who are present at school. On the other hand, proceeding without group members may cause the students who are present to progress more rapidly than the absent student to the point where the absent student would not be able to successfully rejoin the group. In this case, the teacher may need to use a 1:1 supplement arrangement on the return of the absent student.

Another option would be for the teacher to use the days in which students are absent to review material with the present students and introduce new stimuli only when the entire group is present. When students are being taught different tasks and/or different stimuli, then more absences may be accepted than when students are being taught the same task and same stimuli. The teacher should determine in advance the criteria that will be used which will make the most efficient use of all members' instructional time.

What Procedures Will Be Used?

Once teachers have made all the necessary decisions concerning how the group will be formed, they are now ready to plan for instruction. This involves consideration of the instructional strategy, attentional cue, presentation of the discriminative stimulus, trial presentation, choral and individual responding, teacher consequences for student responding, and individual or group criterion.

Instructional strategy. One of the first decisions teachers should make is what specific instructional strategy will be used during small group instructional sessions (Wolery, Ault, & Doyle, in press). In determining the instructional method the teacher should consider the effectiveness of the strategy, the efficiency of the strategy, and the principle of parsimony. Effective instructional procedures that have been used in small group instruction include the system of least prompts (Doyle et al., 1989; Schepis, Reid, & Fitzgerald, 1987) prompt and fade (Fajardo & McGourty, 1983; Koegel & Rincover, 1974), error correction (Brown & Holvoet, 1982; Favell et al., 1978), progressive time delay (Browder, Snell, & Wildonger, 1988; Farmer, Gast, Wolery, & Winterling, 1989), and constant time delay (Gast, Wolery, Morris, Doyle, & Meyer, in press; Doyle, Gast, Wolery, Ault, & Farmer, in press). In determining the efficiency of each of the procedures, the teacher should consider variables such as the trials, sessions, instructional time, and errors to criterion, and the amount of additional observational information that is learned by students. Observational information refers to information not directly taught to a student, but that the student observes being taught to others. In addition, teachers should select instructional strategies on the basis of parsimony (Etzel & LeBlanc, 1979). This principle states that when two or more solutions are correct, then the simplest solution should be used. For example, the least complex strategy or the strategy with which the teacher is the most familiar should be used over other strategies. The effectiveness and efficiency of these instructional strategies have not been compared by researchers in small group arrangements, however comparisons have been made with 1:1 arrangements (Ault, Wolery, Doyle, & Gast, 1989). Data from these studies indicate that response prompting strategies (i.e., system of least prompts, time delay) were more effective and efficient in terms of errors to criterion than error correction strategies. Time delay procedures were more efficient in terms of trials, sessions, errors, and instructional time to criterion than the system of least prompts (Godby, Gast, & Wolery, 1987; Doyle, Wolery, Gast, Ault, & Wiley, in press). In addition, constant time delay is more parsimonious than progressive time delay since only one prompt delay interval is used. Although these comparison results are from 1:1 rather than group instructional arrangements, one might conclude that similar results would be found. Therefore, based on the effectiveness, efficiency, and the principle of parsimony, and given that students possess the necessary prerequisite skills, the constant time delay procedure may be the procedure of choice when determining an instructional strategy to use in a small group format. A more detailed review of instructional strategies within small group arrangements has been conducted by Gast, Doyle, Winterling, and Wolery (1989).

Attentional cue. When teaching in a group, the teacher may choose to use an attentional cue, that is some cue that precedes the delivery of the task direction or material presentation that ensures the attention of the student to the instructional stimuli. A general attentional cue can be used in which group members are simply asked to attend to the stimuli in general (e.g., "Eyes forward", "Look at this"), or a specific attentional cue can be used in which group members are required to attend to the relevant characteristics of the stimuli (e.g., students match the numeral before naming it, or calls the letters of the word in sequence before reading it). A specific and general attentional cue was compared by Alig, Wolery, and Gast (1988) in teaching sight word reading to a group of preschoolers with developmental delays. The general cue consisted of the teacher asking the student to look at the stimulus cards. The specific cue entailed the teacher saying the letter names of the words and requiring the students to repeat them prior to reading the word. Results indicated that students learned to read their target words regardless of the use of a general or specific attentional cue. Students were able to expressively read and receptively identify some of the other group members' words. This occurred most often for those words taught with a specific attentional cue rather than those taught with a general cue. When the goal of the group is to facilitate observational learning, the teacher may want to use a specific attentional cue. Regardless, some type of attentional cue is important for ensuring student attention during group instruction. The teacher also needs to decide if the attentional cue will be presented to only the student whose turn it is or to all members of the group on each trial. For example, Wolery et al. (1989) taught students with mild handicaps to read sight words. A specific attentional cue that was presented to the target student (i.e., only the target student responded) was compared to an attentional cue presented to all students at the same time (i.e., students responded chorally). The specific attentional cue consisted of the teacher orally spelling the word and the student repeating the spelling. Results indicated that no consistent differences across students were found between individual and choral attentional responses in terms of students' ability to read the target and observational words and spell target words. However, students consistently were able to spell more observational words taught with a choral attentional response than with an individual response. It is difficult to make a recommendation since this component of group instruction has not been studied extensively. Until more data are available, however, the teacher may want to deliver a specific attentional cue to all students since it is possible they may learn additional information that is presented in the cue, and attention to task may be facilitated. One should keep in mind, however, that specific attentional cues that require a student response is likely to slow the instruction and lengthen the session time.

<u>Presentation of the discriminative stimulus</u>. After delivery of the attentional cue, the teacher should now present the discriminative stimulus (S^D) or the signal for students to respond. With group instruction, the teacher should closely attend to how students are seated or positioned in the group. If an auditory S^D is used, the teacher must ensure that all students can hear adequately. Likewise, all students must be able to easily see the stimulus materials. Students should also be able to see and hear each other respond

especially if stimuli can be learned through observation. Students should be positioned so that they are not too crowded, but close enough together so they do not have to strain to see, hear, or touch the stimuli if necessary. Some options that teachers can use to ensure optimal responding include seating students around a horseshoe-shaped table with the teacher seated on the opposite side of the table (Gast et al., in press); having students stand on the same side of a table while the instructor models motor responses on the table top (Wolery et al., 1989), presenting flashcards to the entire group (Doyle et al., in press), using a blackboard to present stimuli to all students (Boyer, 1987), and providing each student with their own set of materials if individual responses during the group are needed such as the use of "magic slate" boards or paper and pencil for writing tasks (Keel & Gast, 1989; Winterling, 1989).

Trial presentation. Following delivery of the task direction, the teacher now needs to decide how the trials will be presented. Decisions the teacher must consider include such things as predictable/unpredictable trial sequence, the number of trials presented per student, and the trial presentation format. First, if the teacher has students respond individually, a decision should be made whether trials will be presented so that students in the group can predict or not predict when they will receive a trial. Obviously, if the teacher presents trials in a round-robin fashion (e.g., always presents trials to students in order from left to right), some students may be able to predict when it will be their turn. On the other hand, if the teacher randomizes trial presentation, students cannot predict when they will receive a turn. In a study conducted by Ault, Wolery, Gast, Doyle, and

Martin (1988), students with mild handicaps were taught to read words under two conditions; a predictable trial presentation condition was compared to an unpredictable trial presentation condition. Results indicated that no substantial differences between the two conditions occurred in terms of attention to task and students' ability to read observational words. Predictable and unpredictable trial presentations have not been compared with students with moderate or severe handicaps. Until more data become available on this component of group instruction, teachers may want to use an unpredictable trial sequence since it may help facilitate attention, thereby enhancing acquisition and observational learning. On the other hand, if predictable trial presentation formats are easier to implement for the teacher, they should be chosen. Until more research is conducted, teachers should present trials based on personal preference and analyze the effects with their own students.

Second, the teacher should decide how many trials will be presented each session. This should include the number of trials each individual student will receive and/or the number of trials for the entire group. If students respond individually during the session, the session length will naturally increase as the number of trials presented to each student increases. In addition to determining the number of trials, the teacher should decide if the number of trials will be constant or variable across instructional sessions. Four possible ways that trials can be manipulated during sessions are presented in Table 1. Of these, constant trial presentations may be the easiest for a teacher since the teacher always delivers the same number of trials to each student and summarizing the data is also simplified. Variable trial presentation, although slightly more complicated, gives teachers flexibility during instruction. Examples of variable trial presentations may occur when a teacher (a) chooses to present extra trials to a student who makes an error or needs extra help (Faw et al., 1981; Gaylord-Ross, Forte, Storey, Gaylord-Ross, & Jameson, 1987), (b) teaches skills that are variable by their nature (i.e., the number of trials presented during a grocery shopping activity is dependent on the number of items on the shopping list) (Gaule, Nietupski, & Certo, 1985), and (c) sets a time limit on a session causing the number of trials to vary (Browder et al., 1988).

Insert Table 1 about here

Third, the trial presentation format should be selected. Trials can be presented in a massed, spaced, or distributed format (Mulligan Guess, Holvoet, & Brown, 1980). For purposes of this manuscript, massed trials are defined as each student receiving trials that occur so closely together that no behavior can be expected to occur between them. Massed trials have an intertrial interval of less than 10 seconds. Use of massed trials was reported by Brown and Holvoet (1982) in teaching clerical skills to adolescents with profound handicaps. The teacher presented three massed trials to one student on his targeted behaviors before presenting three massed trials to the next student. Spaced trials refer to trials that are presented so that an individual student has a rest period, pause, or noninstructional activity that occurs between trials from the same program. The intertrial interval , equal to or greater than 10 seconds. Fajardo and McGourty (1983) used spaced trials in teaching social/leisure skills to a group of students with moderate, severe, or profound handicaps within the context of playing a table-top game. Students received trials when their turn naturally occurred in the game. Distributed trials refer to an individual student receiving trials on one or several different skills between trials from the same program. Writing skills were taught in this format to a group of elementary students with learning disabilities (Stromer, 1977). Students worked on specific writing assignments with trials presented only at intervals when a letter reversal occurred.

To present trials in a massed trial format, the teacher can use choral responses from the students or deliver massed trials in sequence to individual group members. Teachers may choose to deliver massed trials using choral responding if their students perform better with fast-paced instruction or are not able to wait appropriately between trials. When all students are learning the same target behaviors, massed choral responding can decrease the session length. Massed trial formats can also be used in which the teacher chooses to present several trials to one student before presenting trials to another student. This may increase the session length and the length of time a student must wait for a turn to respond, but it allows the teacher to present different target behaviors to each student, thus, creating an opportunity for observational learning to occur. Finally, massed trials may offer a format for teachers to present repeated corrective trials to an individual student following an error.

Spaced trials can also be delivered using either a choral response from all students or an individual response from each student in the group. Several advantages exist when using spaced trials. First, the teacher has an amount of intertrial time available to rearrange materials for the next trial or to allow students time to consume reinforcers. Also, when students are responding individually, observational learning opportunities are created as students watch each other take turns. Teachers may be the most familiar with this format since it is probably the most widely used group arrangement implemented in classrooms.

The distributed trial presentation format has not been widely used in small group instruction in the research literature, however, it does present several advantages for the teacher. A teacher who is teaching functional skills may find that distributed trials are a good option since these skills usually occur during the natural routine of the day. For example, students are usually required to wash hands before lunch and after each bathroom visit. The teacher may choose to teach this skill during those times. Some additional planning time may be involved in distributed trial format since the teacher must identify times during the day when instruction on a naturally occurring event can take place for several students at the same time. If the teacher chooses to use a distributed trial format during a single session, several target behaviors will be taught. For example, students may receive distributed trials of name-writing interspersed with instruction on another content area. The teacher may need to explore various ways of using distributed trials due to limited research regarding the use of this format in small groups. It is possible that the distributed trial format may prove to be the most natural way to teach during the school day and may be especially useful in facilitating generalization.

In operationalizing the use of massed, spaced, or distributed trials, the teacher may choose a combination of these formats. For example, some teachers may choose to begin with massed trials and then deliver distributed trials during a generalization phase of instruction. The choice of one format over another is an arbitrary decision to be made by the teacher depending upon the success of the students in the classroom with each format.

Choral and individual responding. An important variable to consider when designing group instruction is how the teacher will have the students respond. Students can respond in unison (i.e., chorally) or individually while the other students watch. Few research studies have investigated the use of choral versus individual responding as a component of groups. However, Sindelar, Bursuck, and Halle (1986) did compare a choral with an individual response in teaching sight word reading to students with mild handicaps. The results indicated that choral responding resulted in the students learning more words, even though the difference between the two responding conditions was minimal. If the teacher chooses to use choral responding, all students in the group would be learning the same stimuli, so opportunities for observational learning would not be present. During sessions using choral responding, students are always actively involved and the opportunities for each student to respond are increased. Of course, the teacher must at some time test students individually to determine mastery of skills (Heward, Courson, & Narayan, 1989). If the teacher chooses to have students respond individually, there will be times during each session in which each student is not actively involved. If students are learning different stimuli, they will have the opportunity to learn non-targeted information by watching the other members of their group.

Consequences for responding. To keep students motivated to respond and to give them feedback on the correctness of their response, teachers should plan what consequences will be delivered following each type of student response. The teacher may choose to deliver verbal feedback only, or verbal feedback plus individual reinforcers identified for subjects (e.g., activity, tangible, edible). These consequences may be delivered following each correct response or at the end of an entire session and to the target student only or to the entire group. Likewise, the teacher should plan consequences for incorrect responses or for failure to respond. The teacher can ignore the error (i.e., say nothing), provide a mild reprimand (i.e, say "No," or "Wrong"), model the correct response, model the correct response and have the target student repeat it, model the correct response and have the entire group repeat it, provide massed trials on the stimuli receiving the error, conduct a brief in-seat time-out (e.g. 10 seconds), or use a combination of two or more of these consequences. Since comparisons have not been made on the preferred consequence to use following correct and incorrect responses, teachers should rely on their best judgment concerning the consequences they will use. Group instruction provides an advantage over teaching students in a 1:1 format in that students can observe the consequences delivered to their peers for correct and incorrect responses; this may positively affect their own responding.

Individual and group criterion. As with all instruction, the teacher needs to decide what criterion will be used to determine when students have mastered a skill. In group instruction, the teacher can decide to set an individual or a group criterion. When an individual criterion is used, each student receives instruction on a behavior until s/he meets the set criterion. For example, Krantz, Zalenski, Hall, Fenske, and McClanahan (1981) taught verbal and written language skills to students with autism. When a student attained 90% accuracy, the difficulty of the task was increased for that student. In contrast, when a group criterion is used, all members of the group must meet the criterion as a unit before the skill is considered mastered. Fajardo and McGourty (1983) taught students with mild to profound handicaps to play a game using a group criterion. All students were required to receive three correct unprompted responses on the game before a new game was introduced to the group. When the teacher uses an individual criterion, there are both advantages and disadvantages. Students in the group are allowed to progress at their own pace and more information can be taught to these students that learn faster than other members of the group. Alternatively, observational learning may be minimized since the number of trials presented on each stimulus varies depending upon the acquisition rate of the student. The management of an individual criterion may also be more difficult since the teacher must closely monitor when each student meets criterion and change stimuli accordingly. In addition, some students may be receiving instruction on a continuous reinforcement schedule while some are on a variable reinforcement schedule; still others may be receiving probe or baseline trials. This all adds to the complexity of using an individual criterion. Group criterion, on the other hand, is less complex since all students remain on the same reinforcement schedule and learn the same task until everyone meets criterion. Some tasks naturally lend themselves to group criterion. For example, tasks such as game playing or vocational skills may be dependent upon the participation of all students in the group in order for the task to be completed. Although observational learning may be facilitated by using a group criterion, students who progress faster than other members of the group may receive repeated trials on a task they have mastered, thus deterring them from learning additional information. Teachers should decide, based on the characteristics of the group members, the size of the group, the task being taught, and their experience in group instruction, which criterion will best enable their students to meet with success.

How Will Learning Be Measured?

When designing instructional programs, the teacher should measure if students are learning with the chosen procedures, how well they are learning, and if they are able to use the information learned outside of the specific training setting and procedures.

Effectiveness measures. Obviously, the most important variable to measure in any type of instructional program is how effectively each individual member of the group learns individual target behaviors. Researchers have collected these data in similar ways including: pre-and post-test measurement (Livi & Ford, 1985), trial-by-trial recording (Gast et al., in press), or through the use of permanent products (Stromer, 1977). Teachers can collect data during small group instruction for each individual member and/or for the entire group. It is recommended that the teacher ensure that data on the performance of individual members are collected regularly in order to make sure that all members of the group are progressing. To demonstrate the effectiveness of the intervention being used, teachers may wish to evaluate student learning by using an experimental design (Tawney & Gast, 1984), and at the very least should collect baseline data prior to implementing the intervention (e.g., AB design). Experimental designs that have been used by researchers include: an AB design (Storm & Willis, 1978), multiple probe design (Farmer, et al. 1989), and multiple baseline des.gn (Brown & Holvoet, 1982).

Efficiency measures. Throughout group instruction, other measures can and should be collected. Teachers should collect efficiency measures to determine how well students are learning with the procedures and to determine which procedures make the best use of teacher and student time. For example, the teacher can measure how efficiently students learn a target behavior in terms of the number of sessions (Marchetti et al., 1984), trials (Oliver & Scott, 1981), errors (Singh, 1987), and minutes of instructional time (Kohl, Wilcox, & Karlan, 1978) to criterion. Another way to measure efficiency is to evaluate whether students learn additional information during the use of group instruction. That is, students may not only learn target information, but information being taught to other members of the group (i.e., observational learning) as well. If this occurs, the teacher's time has been well spent since students have learned information without direct teacher instruction. For example, when teaching students with moderate handicaps to read words, Singh (1987) compared individual with group instruction. During instruction, each student read a different passage in a book. Results indicated that following group instruction, students were able to read some of the words taught to the other members of their group. Teachers should collect efficiency data on several of their instructional programs so that comparisons can be made regarding which of the programs makes the most efficient use of both teacher and student time.

Summarizing data. As with all instruction, data should be summarized using measures such as percent of correct responses, number of steps completed correctly, etc.. It is always important to graph data so that a visual representation of the data is continually available which allows the teacher to quickly recognize when a change in the program is needed. Data for each group member as well as the entire group should be collected (Franzini, Litrownik, & Magy, 1980) and graphically displayed. When the data from the entire group are summarized, the teacher must calculate a mean of all group members' responses. While it is necessary to have individual graphs to monitor the performance of each student, group graphing is useful when a group criterion is used, for public posting, for monitoring group contingencies, and for comparing group data in order to make instructional decisions (Westling et al., 1982; Franzini et al., 1980).

Generalization and maintenance. Generalization and maintenance measures should also be collected to ensure that students can use the skills they have learned in novel situations and maintain them over time. Evaluation of these data will indicate if further programming is necessary. To assess how well students can use what they have learned in other environments, the ability of students to use their acquired behavior should be measured in the presence of other people (Krantz et al., 1981), in other settings (Keogh, Faw, Whitman, & Reid, 1984; Krantz et al., 1981), and with other materials or tasks (Handleman & Harris, 1983; Krantz et al., 1981). Maintenance checks can be collected after a specified number of sessions, days, weeks, or months. The research literature most frequently reports maintenance checks collected at 2 week intervals (Collins & Gast, 1988).

<u>How Will Group Behavior Be Managed?</u>

The teacher needs to plan before the first group session is held, how inappropriate behaviors of students will be systematically managed if they occur during the instructional session.

<u>Group contingencies</u>. To ensure that students in the group demonstrate appropriate behaviors, the teacher should have a plan for managing inappropriate behaviors that may occur. Independent, interdependent, or dependent group contingencies are all options the teacher may want to consider (Kerr & Nelson, 1989; Litow & Pumroy, 1975). First, independent group contingencies refer to those contingencies in which students receive reinforcement based on their own behavior. For example, when Krantz et al. (1981) taught a group of elementary students with autism to describe objects, tokens and points were delivered on an individual basis when students sat quietly while others responded. Second, interdependent group contingencies refer to those contingencies in which all students receive reinforcement based on a specified level of group performance. This might include all group members individually reaching a set criterion or the average of all group members' performance meeting a set criterion. An interdependent group contingency was used by Gersten and Maggs (1982) in teaching language and reading skills to students with moderate handicaps. All students were required to attend and respond before receiving a token and progressing to a new task. Third, dependent group contingencies refer to those contingencies in which all students in the group receive reinforcement based on the performance of one or more selected group

members. Winterling (1989) taught word reading to a group of students with mild handicaps. On the average of every third trial, one student was randomly selected and scored as attending or not attending. If the student was attending, s/he earned one penny for the entire group. At the end of the session if an adequate number of pennies had been earned, these pennies were traded for a back-up reinforcer for all members of the group.

Group contingencies can be used by the teacher to facilitate appropriate social behaviors in the group and/or to facilitate attention to task during the group session. Teachers should assess group members for appropriate social and attentional behaviors when deciding if a group management contingency will be needed. Independent group contingencies may be used by teachers if they prefer to reinforce each student based on individual behavior. This contingency, however, does not structure any interactions between the members. If an individual student is especially disruptive (e.g., responds out of turn, hits, kicks, refuses to participate, inappropriately socializes with others), specific contingencies should be developed for that individual. This may include reinforcing students for appropriate attending, ignoring the inappropriate behavior, reinforcing others for appropriate behavior, issuing a warning, providing an in-seat time-out procedure, using a response cost procedure, or removing the student from the group. With an interdependent contingency, some group interaction takes place. Teachers may choose to use this contingency if they desire to develop group interaction skills, although it is possible that some students may be penalized for the inappropriate behaviors of others. Dependent contingencies may also be used when group interaction is important.

This may be especially useful when only one or two students in the group are not attending or are behaving inappropriately. The teacher runs the risk of putting undue pressure on those students, but this risk may be outweighed by the social reinforcement students will receive from the other group members for appropriate behaviors. There are no "hard-and-fast" rules for the most appropriate contingency to use. Teachers should make a decision based on their own experience and the student characteristics of the group.

Discussion

Since an adequate amount of research has not been conducted on all components of group instruction, many of the decisions made by teachers must be based on their own judgment and experience. The purpose of this manuscript was to make teachers aware of the decisions that need to be made when designing group instruction and to provide recommendations based on an analysis of current "best practice" methodology and the research literature, when possible. Because group instruction provides several advantages over individual instruction to both teachers and students, it is worthy of consideration as a viable format to use in the classroom. It is important for teachers to consider each of the components involved in conducting group instruction and to systematically implement group instructional programs to ensure the success of their students. A checklist, for use by teachers when designing group instruction, that summarizes these components is included in Table 2.

Insert Table 2 about here

Future research should be conducted to assess the best means of conducting instruction in small group formats. Comparison studies of the components of group instruction should be conducted to determine the most effective and efficient way to conduct small groups. Until this research has been conducted, teachers should select group components based on the recommendations of this manuscript and their own experience with what is the most useful for them and the most effective with their students. They should then incorporate the findings of research into their daily practice as data become available.

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Table 1

Constant and variable number of trials within and across sessions in small group instruction

	CONSTANT WITHIN SESSIONS	VARIABLE WITHIN SESSIONS
CONSTANT ACROSS SESSIONS	Each student in the group receives the same number of trials during a session and that number of trials is used every session.	Each student in the group receives a different number of trials, but the number of trials received remains the same each session.
VARIABLE ACROSS SESSIONS	Each student in the group receives the same number of trials during a session, but the number of trials used changes each session.	Each student in the group receives a different number of trials, and the number of trials received changes each session.

Table 2

Checklist of Components of Group Instruction

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
Group Composition	
How many students will be in the group?	
How will the group be composed in terms of age?	Homogeneous or Heterogeneous
How will the group be composed in terms of diagnosis?	Homogeneous or Heterogeneous
Will the same or different task(s) be taught to each student? List the specific tasks.	Same or Different
Will the same or different stimuli be used with each student? List the specific stimuli.	Same or Different
List the specific entry skills needed by each student to participate in the group.	
How will the group be organized?	Intrasequential, Intersequential, Tandem, or 1:1 supplement
How many students must be present in order to conduct the group session?	
Instructional Procedures	
What is the specific instructional strategy that will be used to teach the tasks?	

(table continues)

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
What type of attentional cue and response will be used?	None, Specific, or General
Who will be required to give an attentional response?	Target student or All students
Describe the specific attentional cue and response that will be used.	
How will the S^D be presented to the group? (Consider auditory/visual presentation, physical setting, materials)	
How will trials be sequenced?	Predictable or Unpredictable
How many total trials will be delivered in the session?	
How many trials will be delivered to each student during a session?	
How many trials will be delivered to each student each time it is his/her turn to respond?	
What trial presentation format will be used?	Massed, Spaced, or Distributed
How will the group members respond on target stimuli?	Chorally or Individually
Specifically, what will the teacher do following:	
Correct responses?	
Incorrect responses?	
No Responses?	
Will an individual or a group criterion be used?	Individual or group
What is the specific criterion?	

(table continues)

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
Measurement and Evaluation	
What type of data will be collected to determine if students are learning?	Pre- Post-testing, Trial-by-trial recording, Permanent products, Other
What experimental design will be used?	AB, Multiple probe, Multiple baseline, Other
How will the teacher monitor how well students are learning?	Number of sessions to criterion, Number of trials to criterion, Number/percent of errors to criterion, Minutes of instruction time to criterion, Other
How will student response data be summarized?	Line graph, Table, Cumulative chart, Other
How will generalization by assessed?	Across persons, Across setting, and/or Across materials, Other
How frequently will maintenance data be collected?	
Group Management	
What type of contingency will be used to manage group behavior?	Independent, Interdependent, Dependent, or None

Appendix B

Ault, M. J., Gast, D. L., Wolery, M., & Doyle, P. M. (in press). A data collection and graphing methods for use in teaching chained tasks with the constant time delay procedure. Teaching Exceptional Children.

A Data Collection and Graphing Method for Use in Teaching Chained Tasks with the Constant Time Delay Procedure [1]

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Running Head: CHAINED TASK DATA COLLECTION

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A Data Collection and Graphing Method for Use in Teaching Chained Tasks with the Constant Time Delay Procedure

Instructional research with persons who have developmental disabilities has produced several instructional strategies for teaching new skills (Wolery, Ault, Doyle & Gast, 1986). One of these instructional strategies is the constant time delay procedure (Snell & Gast, 1981). The constant time delay procedure initially involves the simultaneous presentation of the stimulus being taught and a controlling prompt (i.e., the prompt that when given ensures the student makes the correct response). After a specified number of trials or sessions using this simultaneous presentation (i.e., 0-sec delay trials), the teacher delays the controlling prompt by inserting a given number of seconds between the presentation of the stimulus being taught and the controlling prompt. In constant time delay, the prompt is delayed for a fixed amount of time (e.g., 4 seconds). This delay interval is used for all remaining trials until the student consistently responds to the stimulus being taught without the need for the prompt (Wolery, Ault, & Doyle, in press; Wolery, Bailey, & Sugai, 1988).

The constant time delay procedure has been used to teach many different discrete and chained tasks to students with a variety of handicapping conditions ranging from mild to profound mental retardation. Discrete skills, or skills that require a single response, that have been taught with this procedure include matching (McIlvane, Withstandley, & Stoddard, 1984), sight word reading (Doyle, Wolery, Gast, Ault, & Wiley, 1990), manual signing (Kleinert & Gast, 1982), spelling (Stevens & Schuster, 1987), and numeral identification (Ault, Wolery, Gast, Doyle, & Eizenstat, 1988). More recently, investigators have used the procedure to teach chained tasks, or those tasks that involve a number of behaviors sequenced together to form a more complex skill. These have included cooking (Schuster, Gast, Wolery, & Guiltinan, 1988), banking (McDonnell & Ferguson, 1989), laundry skills (Miller & Test, 1990), domestic and vocational skills (Wolery, Ault, Gast, Doyle, & Griffen, in press; Wolery, Ault, Gast, Doyle, & Griffen, 1989) and self-help skills (Schoen & Sivil, 1989). The constant time delay procedure is an efficient procedure in that it may require fewer sessions and trials to criterion than other instructional strategies such as the system of least prompts procedure and may require fewer minutes of instructional time (Wolery, Ault, Gast et al., in press; McDonnell, 1987). Other rationale also exist for using constant time delay. The procedure frequently results in students learning new skills without errors or with errors on less than 6% of the trials (Wolery, Ault, & Doyle, in press). As a result, students perform correctly on nearly all trials and are reinforced frequently by teachers. Thus, the stage is set for positive child-teacher interactions. Further, the procedure is relatively simple to use resulting in little teacher training time and consistent implementation. Also, the procedure is quite flexible in that it can be used to teach many different behaviors including discrete responses and chained tasks such as those found in curricula for independent living. Given the current emphasis on teaching independent living skills to students with moderate and severe handicaps (Snell, 1987), the presence of a procedure that is generalizable across skills reduces teacher training time and planning efforts.

An essential part of a constant time delay program is using appropriate data collection and monitoring procedures. Haring and Kennedy (1988) presented a graphing method to be used when chained responses requiring task analyses are taught. Their method involves graphing the percent of correct responses and coding those data points on the graph to indicate when competent performance has been met. For example, some behaviors in a task analysis may not be critical steps for the student to perform in order to be competent at the task being taught. Although those steps may not be critical, they may increase the ease and smoothness of execution or completeness of the chain. Thus, students may not receive 100% correct responses on the graph, but they may have 100% correct responses on those steps that are considered critical for the student to be competent at the task. A special symbol is used, therefore, to indicate competent performance on the graph. In addition, Haring and Kennedy (1988) suggest that a grid for recording performance on each step of the task analysis be placed at the bottom of the graph; each step of the task analysis is listed to the left of the grid. This gives the teacher a visual analysis of the student's responses on all steps of the task analysis over trials or sessions. They suggest that this method of graphing most accurately represents the data and provides a means to analyze data efficiently.

The purpose of this paper is to demonstrate an adaptation of the Haring and Kennedy (1988) graphing method for constant time delay programs when teaching chained tasks. We used this graphing method with several teachers in several studies and found it beneficial on at least three counts. First, it provides an excellent form of documenting progress including progress on critical and non-crtical steps. Second, the method allows the teacher to record data and display it with the use of one sheet. This reduces transfer time from data collection sheets to graphic displays. Third, and perhaps most important, the method provides teachers with the information needed to make necessary procedural changes when students do not progress as planned. It allows for detailed analysis of the performance which in turn allows for the application of specific data-decision rules and procedural modifications. Examples of these are presented later in the paper.

Getting Ready to Use the Data Collection Sheet

Before teachers can use the data collection sheet, they must be aware of the different types of student responses that can be scored with the constant time delay procedure. During time delay instruction, 5 types of student responses are recorded. Two types of correct responses can occur; unprompted corrects and prompted correct responses. Unprompted correct responses are those correct responses that occur before the teacher delivers the prompt. These are, of course, the responses that the teacher is trying to establish and the only responses that count toward criterion. Prompted correct responses are also considered correct responses and occur after the teacher delivers the prompt. Three types of incorrect responses can occur; unprompted errors, prompted errors, and no response errors. An unprompted error occurs when the student responds incorrectly before the teacher delivers the prompt. A prompted error occurs when the student responds incorrectly after the teacher delivers the prompt, and no response errors occur when the student does not respond after the teacher delivers the prompt. It is important to record all types of responses, since data decision rules may be specific to the type of correct or incorrect response the student is making.

Steps for Using the Data Collection Sheet

A sample data collection sheet and graph that includes actual recorded and graphed data for a shirt folding task are presented in Figure 1. The task was taught to a 10-year old girl with moderate mental retardation (Wolery et al., 1989). In this example, three sessions of probe or baseline data were collected; however, any number of probe sessions can be used with this graphing method. Also, in this example, two instructional sessions at the 0-second delay interval were used because the first session did not result in 100% prompted correct responses. Six steps are described below for using this graphing method.

Insert Figure 1 about here

Step one. When planning instruction, the teacher fills out the situational information on the data sheet such as the student and instructor names, the task to be taught, and the steps of the task analysis.

Step two. Immediately prior to beginning instruction, the teacher indicates on the data sheet the date, session number, notes the start time of the session, and the delay interval (e.g., 0 sec or 5 sec, etc.) to be used during the session. The start time and stop time are used to determine session length and can be collected by using a stop watch or noting the times at the bottom of the form and subtracting the start time from the stop time.

<u>Step three</u>. During instruction, the teacher uses the response grid on the bottom half of the data sheet to record student behaviors. Examples are shown in Figure 2. The diagonal line in each grid square represents the point at which the prompt was given so a response that occurred before the prompt would be recorded above the diagonal line and a response that occurred after the prompt would be recorded below the diagonal line (See Display A of Figure 2). A "+" is used to indicate a correct response, a "-" is used for an incorrect response, and a "0" is used to indicate a no response. Examples of these are shown in Figure 2, Display B and C. In addition, the teacher can, if he or she chooses, record three specific types of errors. A "-T" represents an incorrect topography response. This indicates that the student performed a response other than the correct one which was not another step of the task analysis and which occurred within the designated response interval. For example, step 3 of the task analysis in Figure 1 is "place shirt button-side down on table"; if the student placed the shirt button-side up on the table this would be a topographical error. A "-S" response represents a sequence error. This means that the student correctly did a response in the task analysis, but that it was not in the correct sequence (e.g., performed step 5 rather than step 3). Finally, a "-D" or incorrect duration response indicates that the student performed the correct response but did not complete it within the designated response interval. For example, if the student had 5 seconds to complete a step but took 10 seconds, this would be a duration error. These definitions of errors are mutually exclusive; thus, only one type of error is recorded. Examples of each of these responses are shown in

Figure 2, Display D. During baseline or probe sessions, all responses are recorded before the prompt since no prompt is given (see Figure 1).

Insert Figure 2 about here

Step four. At the end of the session, the teacher notes the stop time and records the session length. The teacher is now ready to review the data for the daily session. Each response is now coded on the response grid so that in the future, a visual analysis can easily be made. For each unprompted correct response that occurred, the teacher blackens in the entire grid square for that response. For each prompted correct response that occurred, the teacher blackens in only the lower half of the grid square for that response. By recording both types of correct responses, the teacher is able to analyze with precision the student's correct responses. The darkening of the grids or portions of the grid make the visual analysis easier. For all error responses, the grid squares are left as is. By coding the responses in this way, the teacher is able to analyze data at a glance.

Step five. The data should now be summarized at the bottom of the graph in terms of the number and percent of each type of response that occurred during the session or trial.

Step six. From this summary data, the teacher plots the responses at the top of the data sheet on a line graph. The session, trial, or date is labeled along the abscissa and the percent or number of correct responses are labeled along the ordinate. Typically with constant time delay data, both unprompted and prompted correct responses are graphed. A closed triangle is used to represent unprompted correct responses, an open circle is used to represent prompted correct responses.

Advantages of the Graphing Method

After use of this graphing method with several studies and teachers, we have found it particularly helpful. Although it requires effort on the teacher's part, several advantages result. This method provides teachers with (a) a systematic means to document progress, (b) an efficient use of time and materials, and (c) an effective way to monitor progress so that appropriate data-based decisions can be made when students are not progressing as expected.

First, the use of the line graph in addition to the response grid, allows the teacher to document progress in a systematic and familiar way. Because line graphs are easily read and understood, they can be used when reporting progress to parents, school officials, documenting progress for school records, presenting data at an educational conference, or when publishing data for an educational journal. Unfortunately, a standard line graph usually does not permit the teacher to analyze a student's performance by each step of the task analysis, thus the addition of the response grid is needed.

Second, this graphing method helps teachers in efficiently using their time and materials. Because the data are collected and plotted on the same data collection form, and all the data are quickly at hand, there is no need for the teacher to shuffle through many data collection sheets when changes in programming are being made.

Finally, the data collection and graphing method allows the teacher to make informed data-based decisions when students are not progressing. This data collection sheet provides the teacher with information on the student's ability to perform on all steps of the task analysis during baseline. Frequently, when collecting baseline data on chained tasks, teachers ask students to perform the task and simply record what steps they did or did not do rather than assessing each step independently. Usually, students perform some of the initial steps, encouter a difficult step, stop responding, and are not assessed on subsequent steps. As a result, the baseline performance may be an accurate description of whether the student can perform the entire chain correctly, but it may under estimate the student's ability to perform each step in the chain. If this assessment procedure is used with the graphing method described here, the teacher should identify on the data collection sheet which steps were not assessed.

A more accurate method of collecting baseline performance, however, requires that the teacher assess the student's ability to perform each step of the task analysis. To do this, the teacher should give the student the opportunity to perform each step of the task analysis. If the student responds incorrectly or does not respond on a step, the teacher should perform that step and then allow the student to continue on the next step. For example, if the teacher is assessing a student's ability to tie his shoes, then the student would be presented with an untied shoe. If the student grasped each string and pulled them tight, then the first steps of the task anlaysis (i.e., grasp one string in each hand, pull on each string to tighten them) would be scored as correct. However, if the student did not wrap one string under the other to make the first knot, then the teacher would perform this step, and present the wrapped strings to the student to see if he would pull them to tighten the first knot. This would continue until the student had an opportunity to perform each step of the shoe tying task analysis. By assessing baseline performance in this way, the teacher obtains an accurate record of the number of steps in the task analysis the student could actually perform before instruction. Thus, the effects of the instructional procedures are more adequately described.

The use of the line graph also provides an immediate visual display of the transfer of correct student responses from prompted correct responses to unprompted correct (independent) responses. This transfer is represented by the plotted unprompted responses intersecting with the plotted prompted responses on the line graph. In Figure 1, this is shown between the second and third instructional sessions. If this transfer is not occurring or is doing so slowly, then the response grid can be used to determine possible modifications to be made. In addition, the response grid allows the teacher to monitor student's progress on each step of the task analysis and make modifications for isolated steps. For example, the student may perform on one or two steps of a task analysis with prompted correct responses, error responses, or inconsistent responding over several consecutive trials. By having the ability to isolate these "troublesome" steps, modifications can be made on only those steps in which the student needs the extra help. For example, the shirt folding data in Figure 1 indicates that the student was having trouble with step 8 of the task analysis. During instructional session 15, the teacher used a 0-sec delay for step 8 only. In such cases, data would only be collected on that step. The following sessions were conducted using a

5-sec delay for all steps. Following this modification, the student was able to respond with unprompted correct responses on step 8.

In addition, since error responses are coded, specific modifications can be made based on the specific type of error response that is occurring. A variety of different response patterns are possible with constant time delay. Potential correct and error patterns are shown in Table 1 along with potential procedural modifications for each type of pattern.

Insert Table 1 about here

Graphing Competent Performance

Haring and Kennedy (1988) also suggest that teachers code the plotted data points on the line graph to represent when competent performance on a task has been achieved. This means that some task analyses contain steps in which the student does not have to perform to be competent at a task. For example, students can still competently brush their teeth even though they do not put the top back on the toothpaste. Therefore, the teacher identifies the steps in the task analyses that are not critical for the student to do to still be able to perform the task adequately. Then, when the student receives 100% correct unprompted responses on all critical steps, a special symbol is used to plot the data for this session. The special symbol could be leaving the data point for unprompted corrects open, or any other symbol the teacher wants to use. This lets the teacher readily identify when the student is competent at a task even though they may not have reached a 100% criterion for all steps in the task analysis.

Conclusion

The constant time delay procedure is an effective and efficient instructional strategy that has been used to teach a variety of skills to students with different handicapping conditions. This paper focused on the use of the procedure in teaching chained responses. The efficiency of the procedure can be enhanced by using the data collection and graphing method that combines a line graph with a response grid that provides data on each step of a task analysis. By using this method, teachers can systematically monitor performance, use their time and materials efficiently, and make informed decisions on procedural modifications based on the substantial and easily read data obtained with the method.

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Table 1

Response Grid Patterns and Potential Procedural Modifications

Potential Modifications	Response Grid Pattern/Description [a]							
	Unprompted Corrects Not Occurring: S waits for prompt, but does not respond before prompt	Consistent Unprompted Errors Occur: On one or more steps, S responds incorrectly before the prompt for a number of consecutive trials Types of Errors: [b]			Consistent Prompted Errors Occur: On one or more steps, S responds incorrectly after the prompt for a number of consecutive trials Types of Errors: [b]			Consistent No Responses Occur: On one or more steps, S does not respond for a number of consecutive trials
		Top.	Seq.	Dur.	Top.	Seq.	Dur.	
Differentially reinforce prompted and unprompted corrects. Prompted corrects receive more reinforcement than unprompted corrects	X							
Teach a waiting response		X	X	X				
Return to 0-sec delay for 1 or more trials		X	X	X				
Modify/change the controlling prompt					X	X	X	X
Modify task analysis by breaking task into finer steps		X	X	X	X	X	X	X
Use massed trials on isolated step until reaches criterion		X	X	X				
Increase the delay interval				X			X	
Use more powerful reinforcers					X	X	X	X
Add/change consequent event for errors		X	X	X	X	X	X	X

[a] S = student

[b] Top. = topography errors, Seq. = sequence errors, Dur. = duration errors

Figure Captions

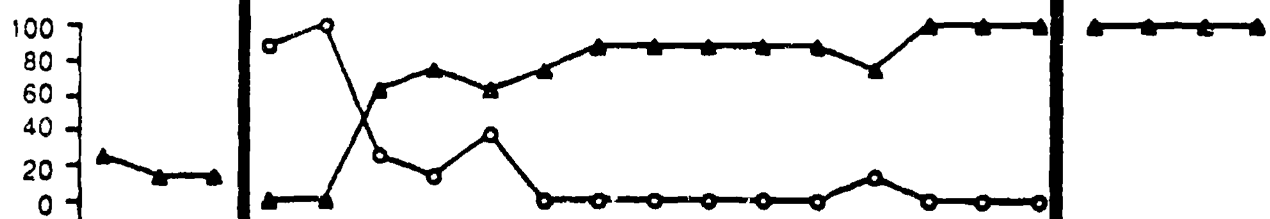
Figure 1. Sample constant time delay data sheet and graph for a chained response (folding a shirt).

Figure 2. Examples of recording different responses in the grid squares. Display A is a blank grid; Display B indicates unprompted and prompted correct responses; Display C indicates unprompted and prompted error responses and no responses; and Display D provides examples of prompted and unprompted topographical, sequence, and duration errors.

Student's Name *Tara* Instructor *A. G.* Task *Shirt Folding*

	Probe I			Constant Time Delay															Probe II			

Percent of Correct Responses



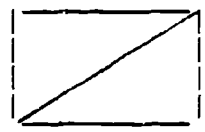
Step	Task Analysis	STUDENT RESPONDING																					
1	Get laundry basket. Put on floor beside table.	0	0	0																			
2	Take shirt out of basket.																						
3	Place shirt button-side down on table.	-T	-T	-T						-T													
4	Turn collar so parallel with left side of table.	-T	-T	-T																			
5	Fold one side of shirt 1/3 of way toward center.	-T	-T	-T												-T							
6	Fold other side of shirt 1/3 of way toward center.		-T	-T																			
7	Pick up collar. Fold shirt in half.	-T	-T	-T	-T																		
8	Pick up shirt. Place on shelf.	-T	-T	-T			-T	-T		-T	-T	-T	-D	-T	-T								
Delay Interval (seconds)		5	5	5	0	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Day of Month (Jan-Feb)/Session		1-17/1	18/2	19/3	20/4	23/5	24/6	25/7	26/8	2-7/9	8/10	9/11	10/12	13/13	14/14	15/15	16/16	17/17	20/18	21/19	22/20	23/21	24/22
Session Time (minutes)		3	3	2	7	5	5	4	4	3	4	3	3	3	2	3	2	2	2	2	2	1	2
Number/Percent Unprompted Corrects		2/25	1/13	1/13	0/0	0/0	5/63	6/75	5/63	6/75	7/88	7/88	7/88	7/88	7/88	6/75	8/100	8/100	8/100	8/100	8/100	8/100	8/100
Number/Percent Prompted Corrects		NA	NA	NA	7/88	8/100	2/25	1/13	3/38	0/0	0/0	0/0	0/0	0/0	0/0	1/13	0/0	0/0	0/0	NA	NA	NA	NA
Number/Percent Unprompted Errors		5/63	6/75	6/75	0/0	0/0	1/13	1/13	0/0	2/25	1/13	1/13	1/13	1/13	1/13	1/13	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Number/Percent Prompted Errors		NA	NA	NA	1/13	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	NA	NA	NA	NA
Number/Percent No Response Errors		1/13	1/13	1/13	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

Key:

+ = correct	T = topography	▲ = unprompted correct	◩ = prompted correct
- = incorrect	S = sequence	O = prompted correct	◿ = error
0 = no response	D = duration	■ = unprompted correct	NA = not applicable

A. Example of a blank square grid:

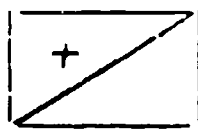
Student response recorded here if it occurred before the teacher's prompt ---->



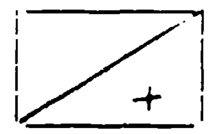
<---- Student response recorded here if it occurred after the teacher's prompt

B. Examples of correct responses before the teacher's prompt and after the teacher's prompt:

Correct Response Before Prompt

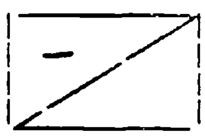


Correct Response After Prompt

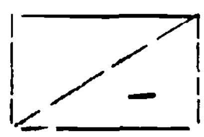


C. Examples of error responses before the teacher's prompt and after the teacher's prompt, and of no response after the teacher's prompt:

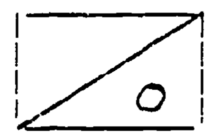
Error Before Prompt



Error After Prompt

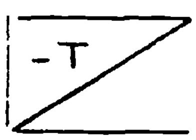


No Response

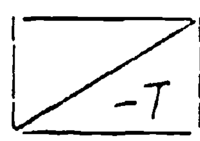


D. Examples of different types of errors before and after the teacher's prompt:

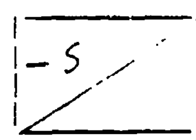
Topographical Error Before Prompt



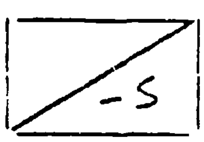
Topographical Error After Prompt



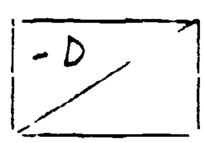
Sequence Error Before Prompt



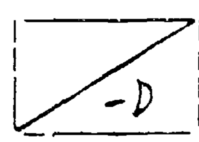
Sequence Error After Prompt



Duration Error Before Prompt



Duration Error After Prompt



Appendix C

Winterling, V., Gast, D. L., Doyle, P. M., Wolery, M. (1990). Effective and efficient small group instruction: The use of constant time delay. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Effective and Efficient Small Group Instruction: The Use of Constant Time Delay[1]

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Running Head: SMALL GROUP INSTRUCTION

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Effective and Efficient Small Group Instruction:
The Use of Constant Time Delay

Teachers should give careful attention to the acquisition of new behaviors when providing instruction to students with disabilities. Teaching new behaviors requires decision-making by teachers on at least two levels. First, teachers must prepare for instruction. They decide the type of behavior to be taught, the number of target behaviors, and the number of students who will be taught. For example, a teacher may decide that she will teach an academic behavior such as sight word recognition to three to four students in a small group instructional arrangement, or to teach photograph identification to one student in a one-to-one arrangement. Second, once teachers identify the target behaviors and arrange the instructional format, they must decide how to teach the behaviors by selecting an instructional strategy. Wolery, Ault, Doyle, and Gast (1986) define an instructional strategy as a systematic approach for providing instruction that addresses what occurs before and after a student responds. A teacher's decisions in preparing for instruction and selecting an instructional strategy should be based on measures of effectiveness (e.g., Has the student learned a new behavior when taught with a particular instructional strategy?), and efficiency (i.e., Will the use of a particular small group instructional arrangement free the teacher to train additional skills that she might have otherwise been unable to teach?).

The purpose of this paper is to describe the use of the constant time delay procedure in small group instructional arrangements. It is a "how-to" guide for using the constant time delay (CTD) strategy, with students of varying ages and ability levels, in small groups. First, a rationale for the use of group instruction for students with disabilities is presented; followed by a description of the constant time delay procedure. Finally, the procedure is illustrated within the context of small group instruction.

Rationale and Supporting Research

Historically, decisions regarding whether to teach students in small groups or in one-to-one contexts were dependent on the clinical judgement and professional preparation of the classroom teacher. The teacher assessed the "readiness" skills of the students and the types of behaviors to be taught and made a decision. The prevailing zeitgeist and an absence of research tended to support the notion that students with mild handicaps could participate in small groups while students with more severe handicaps were best instructed in one-to-one arrangements.

Recently, however, an emerging research base has provided support for the use of small group instructional arrangements for students with more severe handicaps. This support has come from two sources. First, a number of studies involving students with moderate and severe handicaps which compared one-to-one instruction to small group instruction have found that effective learning can occur in small group arrangements (Favell, Favell, & McGimsey, 1978; Oliver & Scott, 1981; Storm & Willis, 1978; Westling, Ferrell, & Swenson, 1982). Second, several studies have found that group instruction has been effective in teaching language and academic skills to students with severe handicaps (Oliver, 1983), moderate handicaps (Doyle, Gast, Wolery, Ault, & Farmer, 1990; Gast, Wolery, Morris, Doyle, & Meyer, in press) and expressive language skills to preschoolers with various developmental delays (Cybriwsky, Wolery, & Gast, in press). Group instruction has also been used to teach tasks in other skill domains. For example, Wolery, Ault, Gast, Doyle, & Griffen (1989) taught pairs of primary-aged students with moderate delays domestic and vocational skills, while Schoen and Sivil (1989) taught self-help skills to pairs of preschoolers with developmental delays. Based on the results of the aforementioned studies, it is clear that small group instructional arrangements represent a viable alternative to one-to-one instruction for many, if not most students with moderate and severe handicaps.

While a number of investigations have demonstrated the effectiveness of small group instruction, some investigators have suggested that small group instruction also increases the efficiency of classroom instruction in several ways (Brown & Holvoet, 1982). First, small group instructional arrangements may increase the probability that students will generalize skills (Brown, Holvoet, Guess, & Mulligan, 1980). Second, small groups can be a more efficient use of teacher time, that is, the teacher is able to provide additional direct instruction of target behaviors to more students (Brown et al., 1980; Fink & Sandall, 1980; Smith & Meyers, 1979; Snell, 1983; Storm & Willis, 1978). Third, small group instruction provides the opportunity to increase the amount of information acquired by students through observational learning. For example, several recent investigations have shown that group members will acquire their own target behaviors and some of the target behaviors taught to their peers (Doyle et al., 1990; Farmer, Gast, Wolery, & Winterling, 1990; Gast et al., in press; Shelton, Gast, Wolery, & Winterling, in press; Winterling, in press). The interpretation of these findings suggest that by programming for observational learning it may not be necessary to provide direct instruction on all target behaviors.

Description of the Constant Time Delay Procedure

The previous discussion suggested that small group instructional arrangements are a viable alternative to one-to-one instruction when teaching new skills to students with disabilities. The decision to use a small group arrangement, however, does not preclude the individualization of instruction or the use of systematic instructional strategies (Brown et al., 1980). The use of a near-errorless response prompting procedure, constant time delay, is an example of a systematic instructional strategy that can be easily implemented in small group instructional arrangements.

In the constant time delay procedure, the teacher delivers both a task direction (i.e., information that tells the student to respond, such as "What word is this?" or the printed word in context), and a controlling prompt (i.e., information that ensures that the student will respond correctly, such as the teacher verbally modeling the correct response). Initially, the task direction and the prompt are presented to the student at the same time. These instructional trials are called zero-second delay trials because the teacher does not allow the student the opportunity to respond before the prompt is delivered. For example, Ms. Andrews is teaching Barry to identify kitchen utensils. She presents the task direction "Find the spatula," and immediately points to the spatula in the kitchen drawer. Because Ms. Andrews has identified a controlling prompt for Barry (i.e., a point), she knows that Barry will respond correctly when she points to the spatula. However, because she wants Barry to find the kitchen objects without her assistance, Ms. Andrews begins to "fade" her prompt after a predetermined number of zero-second teaching trials. This is accomplished by inserting a specified amount of time between the task direction and delivery of the prompt. This type of instructional trial is referred to as a delay-trial because it allows the student time to respond before assistance is delivered. For example, Ms. Andrews presents the task direction, "Find the spatula" but now she waits four seconds for Barry to respond before pointing to the correct object as she counts silently to herself, "one-one thousand, two-one thousand, three-one thousand, four-one thousand" etc. She continues to wait the same amount of time on all remaining instructional trials; that is, the time inserted between the task direction and the prompt stays "constant" until Barry consistently finds the kitchen utensil before the prompt is delivered.

Five different responses are possible when using the constant time delay procedure. There are two types of correct responses and three types of incorrect responses. An unprompted correct response or "anticipation" occurs when the student responds correctly during the delay interval that has been inserted between the task direction and prompt. A prompted correct response or "correct wait" is defined as the student waiting silently for the prompt if he does not know the correct answer and then responding within a reasonable amount of time after the prompt has been delivered. Although the objective of the constant time delay procedure is to teach the student to respond correctly before delivery of the controlling prompt, both types of correct responses (i.e., unprompted and prompted) should be reinforced during instruction. However, only unprompted correct responses count toward criterion. If the student responds incorrectly before the teacher has the opportunity to deliver the prompt, then the student has made an unprompted incorrect response or "non-wait" error. An incorrect response made after the delivery of the controlling prompt is a prompted incorrect response or "wait" error. Finally, a no-response error occurs when the student does not respond within a reasonable time following delivery of the prompt. The consequences that follow each type of correct or incorrect response are dependent upon the characteristics of the student and the target behavior. Descriptive praise and a tangible or token reinforcer frequently are provided for correct responses. Incorrect responses may be corrected, ignored, or the student may be reminded to wait for teacher assistance if he doesn't know the correct response.

Constant time delay has been used to teach a wide variety of skills to persons with a variety of learning handicaps (e.g., Ault, Gast, & Wolery, 1988; Browder, Morris, & Snell, 1981; Schoen & Sivil, 1989; Stevens & Schuster, 1987). Constant time delay has been shown to be effective in teaching receptive, expressive, and signed language tasks (Ault, Gast, Wolery, Doyle, & Eizenstat, 1988; Browder et al., 1981; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Kleinert & Gast, 1982; Wolery, Gast, Kirk, & Schuster, 1988), and functional adaptive behavior skills, including banking (McDonnell & Ferguson, 1989), bedmaking (Snell, 1982), sandwich-making (Schuster, Gast, Wolery, & Guiltinan, 1988), and self-help skills (Schoen & Sivil, 1989).

In summary, the constant time delay procedure has been effective and efficient in teaching different types of responses in near-errorless fashion in small group instructional arrangements. For example, it can be used to teach discrete behaviors; that is, behaviors that consist of a single response. Discrete responses might be receptive tasks such as Barry pointing to the spatula in the drawer, or as an expressive behavior, such as a student reading a community-referenced sight word. The constant time delay procedure also can be used to teach complex skills which have been task analyzed (i.e., chained tasks). In the section that follows several small group instructional programs which use the constant time delay procedure are described. The first program describes how to teach a discrete receptive response to three students during a small group instructional arrangement. In the second program, we describe how to teach an expressive sight word recognition task within the context of a group. In the third program, teaching a chained task in a small group instructional arrangement is described. In each instructional program the critical decisions facing the teacher are outlined, followed by a description of the way in which the constant time delay instructional trials are presented. Each program is accompanied by a sample data collection sheet to record students' responses.

Teaching a Receptive Task to a Group of Students using a Constant Time Delay Procedure

Select the students and identify the target skill. Three students, all female, were selected from a classroom for preschoolers with moderate mental retardation. The three girls, Carrie, Jessica, and Maria ranged in age from 3 years-3 months to 4 years-6 months. Each student was able to sit at a table for a period of 10 minutes without engaging in disruptive behaviors, make eye contact with the teacher, follow simple verbal directions, and imitate gestures. All students previously had received systematic instruction in one-to-one teaching contexts. The students could not receptively identify photographs of common objects found in their environments. The speech pathologist suggested that this was an important behavior for later language development. The teacher, Mr. Juarez, did not have time to conduct one-to-one instructional sessions with each of the three students so he decided to implement a small group teaching activity in which he would teach the three students to identify two objects depicted in photographs.

Planning the small group instructional program. After Mr. Juarez identified the students and decided which skill he would teach, he made several other decisions to ensure the successful implementation of the instructional program. These included: (a) deciding whether to use a predictable or unpredictable trial sequence, (b) whether to have students respond individually or chorally, (c) selecting the photographs to teach and the number of trials per photograph, (d) ensuring student attention throughout the instructional session, (e) specifying consequences for student responses, (f) identifying a controlling prompt, (g) selecting the time delay interval and the number of zero second delay sessions, and (h) establishing a reasonable criterion. The decisions made by a teacher in planning and implementing a small group instructional program are summarized in Table 1. (A more comprehensive discussion of the planning and decision-making process for small group instructional programs is provided by Collins, Gast, Ault, & Wolery, in press.)

Insert Table 1 about here

Mr. Juarez was concerned that the students had never received instruction in a small group instructional arrangement, and that he was going to be teaching a difficult task. Thus, he selected an unpredictable trial sequence. This type of trial sequence ensured that opportunities to respond were randomly alternated among the students throughout the session. Mr. Juarez hoped that the students might be more attentive throughout the session if they didn't know when it would be their turn. Mr. Juarez selected 10 photographs of household items the students regularly used (e.g., knife, bowl, plate). He decided to teach the same two photographs to all students, and to use the remaining eight photographs as distractors. That is, photographs that were presented along with the target photographs during instruction that would ensure that the student was discriminating the target photo from among the other three photos. Because the students were able to sit for periods of no longer than 10 minutes, Mr. Juarez decided that three trials per target photograph for each of the students (a total number of 18 trials per session) would be sufficient to teach the new skill, and could be scheduled daily without difficulty.

Ensuring that the students remained attentive throughout the instructional period was a concern for Mr. Juarez. Thus, in addition to the unpredictable trial sequence, he included several other procedures. First, he decided to use a group attending cue. That is, before the presentation of each instructional trial, he stated "Everybody look" and required eye contact from each student. Second, he provided supplemental reinforcement on the average of every third instructional trial to those students who attended to the students whose turn it was. That is, immediately after Mr. Juarez provided consequences for responding to the photographs, he would praise each student who was attending (e.g., "Maria, I like it when you watch Jessica and Carrie working."). It is important to note that procedures to ensure attention are not always necessary. They are, however, useful adaptations to ensure the attention of students with more severe handicaps or students who have had little previous experience in small group instructional arrangements.

As with any systematic instructional program, clear consequences for student performance should be specified. These include reinforcement for correct performance and some type of corrective when errors occur. Mr. Juarez knew from previous experience that providing stickers to his students was an effective reinforcer. Thus, he provided descriptive verbal praise and a sticker to the students for each correct response during the instructional sessions. Although the constant time delay procedure is described as near-errorless, students may make mistakes on about 5% of the trials. Mr. Juarez decided he would respond to errors in the following manner. If a student made an error during the first two sessions at four second delay, he would tell the student to "wait if you don't know the answer," and then provide error correction. During error correction Mr. Juarez would model the correct answer and the student would imitate his model. The student would receive a brief statement indicating correctness (e.g., "Right."). Errors in subsequent sessions would be managed by using the error correction procedure alone.

Mr. Juarez's next decisions concerned the selection of a controlling prompt, the number of zero second sessions, and the selection of a delay interval. To identify a controlling prompt, Mr. Juarez conducted brief individual screening sessions. During these sessions, he presented objects and told the student to "Do what I do." For example, he asked the student to "Point to the scissors," and modeled the pointing response for the students. All students consistently imitated the pointing response. Therefore, he selected a model as a controlling prompt because all of the students successfully imitated him. Because the students were preschool-age and had never been exposed to constant time delay procedures, Mr. Juarez elected to conduct two zero-second delay sessions. He decided to use four-second delay trials in all subsequent sessions because the students could respond correctly to other known tasks within four seconds. A final issue that needed to be addressed was to establish a reasonable criterion. Mr. Juarez decided to adopt a conservative criterion in order to ensure the students had learned the behaviors. Thus, he decided to provide instruction until all students in the group had attained 100% unprompted correct responding for two consecutive sessions when reinforced each time they made a correct response (continuous reinforcement), followed by one session in which all students performed at 100% unprompted correct responding when reinforced approximately every third time they made a correct response (intermittent reinforcement).

Constant time delay instructional trials. Instruction began with the zero-second delay trials on two photographs. At the beginning of each zero second trial, Mr. Juarez stated, "Everybody look." When all students were looking at him, he presented a target photograph among the three distractors to one of the students. He then asked the student to point to the target photo ("Maria, point to the fork."). Immediately following the task direction, Mr. Juarez pointed to the photograph of the fork. The student then imitated Mr. Juarez and pointed to the correct photograph, at which time she was reinforced with descriptive verbal praise and a sticker. The use of zero-second delay trials was repeated for all of the students on all trials in the first two sessions.

Because all of the students made 100% prompted correct responses in the first two sessions, Mr. Juarez began his next session (the third session) by inserting a four-second delay interval between the task direction and the delivery of the controlling prompt. These sessions were very similar to the zero-second delay trials, except that after providing the general attention cue ("Everybody look") and the task direction ("Maria, point to the fork"), Mr. Juarez counted, "One-one thousand, two-one thousand, three-one thousand, four-one thousand" to himself before he modeled the correct answer. Mr. Juarez provided consequences to the members of the group based on their responses, as he had done during the zero-second delay trials. After each instructional trial, Mr. Juarez recorded the student's response on a data sheet designed for the receptive task he was teaching. This was followed by presenting an instructional trial to another student in the group. The session continued until each student had received six instructional trials (i.e., three trials on each of the two photographs). Mr. Juarez continued to provide four-second delay trials each session until all of the students met the criteria he established at the outset of the instructional program.

Insert Figure 1 about here

Teaching an Expressive Task to a Group of Students using a Constant Time Delay Procedure

Select the students and identify the target skill. Ms. Smith had two male and two female students (Jon, Michael, Sabrina, Cheryl) aged 10 years-1 month to 11 year-2 months, with moderate to severe mental retardation, who were participating in community based instruction. However, there were a number of sight words that the students frequently encountered in community settings that they were consistently unable to recognize despite repeated exposures. Before deciding which of the sight words to teach her students, Ms. Smith conducted a prescreening session. The prescreening session confirmed her suspicion that of the approximately 20 community-referenced sight words the students frequently encountered, her students could recognize approximately two of the words. Thus, Ms. Smith decided to teach five different unknown words to each student in a small group instructional arrangement.

Planning the small group instructional program. After she had determined the words that each student would be taught, Ms. Smith decided to use an unpredictable trial sequence. In addition, the target words for each student were alternated daily to ensure that the order of the words would be different. She used the unpredictable trial sequence for two reasons. One, like Mr. Juarez, Ms. Smith wanted to ensure her students were attentive to each instructional trial. Two, she thought that if the students attended to the instructional trials given to their peers, then they might learn additional words through observational learning.

To facilitate student attention and observational learning, Ms. Smith used a group attending cue (e.g., "Everybody look"), and she instituted a dependent group attention contingency. This contingency specified that each student would have five trials (also presented in an unpredictable sequence) on which Ms. Smith would note whether the student was attending when she gave the group attending cue (i.e., "Everybody look"). If the student was attending on his respective instructional trial, then he could earn additional reinforcers for the entire group.

Ms. Smith decided to provide three trials on each of the five words she was teaching to the four members of the group. This meant she would be presenting a total of 60 trials per session. Given the number of trials in each session, Ms. Smith took some extra time to prepare her instructional materials. She made separate index cards for all of the target words (a total of 60 cards). Having each word on an index card saved time during instruction because the cards only had to be shuffled once each session. She saved extra time during instructional sessions by listing each student's name and target word in the random order they would be presented during instruction on the data sheet. She recorded each student's response on the expressive task data sheet after each instructional trial throughout the session.

Insert Figure 2 about here

Ms. Smith also decided to use token reinforcement and descriptive verbal praise during instruction. After each trial on which the student responded correctly, Ms. Smith stated, "Good, that is the word Pepsi," and gave the student a penny. Pennies could be used to purchase items Ms. Smith knew each student found reinforcing, including free time. When a student made an error, Ms. Smith told the student he was incorrect, and to wait for her to provide the answer if he didn't know the answer.

Ms. Smith's students could verbally imitate all of the target words consistently. Thus, a verbal model of the target word was used as the controlling prompt throughout training. Ms. Smith provided one 60-trial session at zero second delay and all subsequent sessions consisted of four-second delay trials.

Finally, she employed a criterion that specified individual and group performance. This type of criterion specified that each student had to achieve an individual criterion of one session at 100% unprompted correct responses when reinforced each time he made a correct response. When all students had achieved the individual criterion, the group criterion specified that all students in the group had to perform at 100% unprompted correct responses when reinforced on the average of every third correct response. He adopted this type of criterion to ensure the students had learned the words before conducting generalization training in the community.

<u>Constant time delay instructional trials</u>. Instruction began with one session at zero second delay. During this session, Ms. Smith provided the general attention cue ("Everybody look"), presented the word card to an individual student, asked "What word is this?", and then immediately stated the correct response. After the student imitated the correct response, Ms. Smith provided descriptive praise and a penny. She repeated this for the 60 trials that comprised the first session.

Beginning with the second session and for all subsequent instructional sessions, Ms. Smith used four second constant time delay trials, which were conducted in the following manner. Ms. Smith provided the attention cue, presented the word card to a student, and asked, "What word is this?" She then counted four seconds (e.g., "One-one thousand, two-one thousand," etc.) to herself. If a student responded within the four second interval, he was reinforced with descriptive praise and a penny. If the student did not respond within four seconds, Ms. Smith modeled the correct response, and the student imitated her model within five seconds. The student was reinforced with descriptive praise and a penny. When a student responded incorrectly, he was told that the response was incorrect and asked "to wait if you don't know the answer." This was followed by presenting an instructional trial to another student in the group. The session continued until each student had received 15 instructional trials (i.e., three trials on each of the student's five target words). Ms. Smith continued presenting four-second delay trials until all students had achieved both the individual and group criteria.

Teaching a Chained Task to a Group of Students using a Constant Time Delay Procedure

Select the students and identify the target skill. Mr. Jones had three students (Billy, Ralph, and Freddy) aged 16-18, with severe mental retardation who were employed at a local business. Because the students worked during the lunch hour, his students needed to bring their lunch to the job site. This provided an opportunity to teach his students to make a sandwich. Mr. Jones wanted his students to learn to use a variety of sandwich materials, thus he decided to teach the students to make three different sandwiches. After he decided what sandwiches to teach his students to make, he developed task analyses for each sandwich. The task of making sandwiches was a difficult one for his students, therefore, each step in the task analyses consisted of a small amount of information to ensure that the students could learn in a reasonable amount of time.

Planning the small group instructional program. Because Mr. Jones wanted the students to perform the behaviors of each task analysis in sequence, he elected to use a predictable trial presentation; that is, one in which trials were always presented in the same order. To ensure that the students remained attentive throughout the teaching sessions, Mr. Jones required that the students make a choral response on each step of the task analysis. In choral responding the teacher presents the task request to all students in the group and all students respond in unison. Finally, due to the difficulty of the task, Mr. Jones decided to teach the task as a backward chain. He did so for the following reasons. First, when the task analyses for the three sandwiches were completed, he found that in order to make each step sufficiently discrete, he would need to teach approximately twenty to twenty-five steps for each sandwich. He decided that teaching this much new information in each session probably would be too difficult for his students resulting in a high percentage of errors. Thus, teaching one step at a time would be easier for his students to learn and therefore was a more reasonable approach. Second, because he was teaching this skill in a group instructional arrangement, it would be easier to collect data on one training step as opposed to 20-25 steps. Third, Mr. Jones decided to capitalize on the use of backward chaining by having the students practice each step leading to the target step during each instructional trial, in the hope that this practice would facilitate acquisition of future steps. The students performed one complete task analysis each day. When the target step was acquired by each student in the group, they began training on the next (i.e., second to last) step. This continued until they had learned all steps in the task analysis. Mr. Jones then began instruction on the next type of sandwich.

Before selecting a model as a controlling prompt, Mr. Jones conducted several screening sessions in which he asked the students to perform individual steps of non-targeted food preparation skills. During these sessions, he assessed the students' abilities to imitate his behavior. The results of these screening sessions revealed that two of the three students could correctly imitate Mr. Jones' behavior. However, the third student imitated Mr. Jones inconsistently. As a result, Mr. Jones decided that he would use a model as a controlling prompt for two of the students and a physical prompt for the third student. During instructional sessions, instead of modeling the behaviors of the sandwich making skills for the group to imitate, Mr. Jones used the student who required a physical prompt as the model for the other students. That is, he provided a physical prompt to the one student who required it, and the other students were instructed to imitate the behavior of the student receiving the physical prompt.

Consequences for performance included the use of reinforcement for correct responses and error correction for incorrect responses. Correct performance on all training steps was reinforced with descriptive praise (e.g., "Good, you spread the mayonnaise on the bread."). If a student made an error on a training step before the prompt, he was told to "wait if you're not sure what to do," and the correct step was modeled for the student. Following the teacher's model of the step, the student imitated the teacher's model. Errors on non-training steps were ignored and the teacher arranged the student's sandwich materials to facilitate completion of the next step.

Mr. Jones elected to use a group criterion to evaluate the students' performance of the sandwich-making skills. The criterion specified that the students had to perform for two consecutive days at 100% unprompted correct responses when reinforced for each correct step, followed by one day at 100% correct when reinforced on the average of every third correct response and finally respond at 100% unprompted correct responses when reinforced only at the end of the tasks (e.g., after 25 steps).

<u>Constant time delay instructional trials</u>. The zero-second delay instructional trials were conducted in the following sequence. The teacher presented the task direction, the student

who required a physical prompt was guided through all of the steps in the chain, and the students imitated that student. Immediately following the completion of the next to the last step, Mr. Jones delivered the controlling prompt for the target step. The students imitated the behavior of the student who received the physical prompt. Following completion of the task analysis the students were reinforced with descriptive praise.

During five-second delay trials, the steps were modeled as described above. However, immediately following the completion of last non-training step, Mr. Jones began counting to himself (i.e., one-one thousand, two-one thousand, etc.) before he provided the controlling prompt. During five-second delay trials, Mr. Jones provided consequences in the following order. First, he provided reinforcement to the students who made an unprompted correct response. These students received descriptive verbal praise. Second, students who made unprompted errors, and those waiting for a prompt, received consequences at the same time. The students who made an incorrect response were told to wait and received a correction trial which served as the controlling prompt for the students waiting for assistance. Ms. Smith recorded data on the students' responses on a data sheet for chained tasks after the last student received consequences on each training step. Training proceeded in this sequence until all students had met the group criterion for each sandwich.

Insert Figure 3 about here

Problems Implementing Small Group Instructional Arrangements

Implementing systematic instruction in small group arrangements occasionally may prove problematic. Some problems are specific to conducting group instruction (Collins et al., in press), and some are specific to the use of constant time delay procedures (Schuster & Griffen, in press; Snell & Gast, 1981; Wolery, Ault, & Doyle, in press). Problems that might be encountered when implementing group instruction may include the selection of students with disruptive behaviors, those who lack prerequisite skills or who attend school infrequently, the identification of a skill which is too difficult for some group members, and the use of ineffective consequences for performance. Solutions for these types of problems can be addressed by carefully assessing prospective group members prior to their inclusion in the group and by employing systematic instructional practices (e.g., Snell, 1987; Wolery, Bailey, & Sugai, 1988). Problems that might be encountered with the use of the constant time delay procedure include a high percentage of unprompted errors (i.e., more than 25% of the total amount of the student's responses for a session), a high percentage of prompted errors, and the failure to make unprompted responses. Unprompted errors can be managed by reminding many students to wait if they do not know the correct response, providing negative consequences for failing to wait, or by shortening the delay interval. For some students wait training may be necessary (Snell & Gast, 1981). High percentages of prompted errors indicate the need to reevaluate the controlling prompt and identify one that ensures correct responses. Students who fail to make an unprompted correct response often need to be taught that it is okay to make a response if they know it. Some students may require a change in the way consequences are delivered. That is, the teacher may want to tell the student that rewards will only be provided to students who respond before the prompt is provided (i.e., differential reinforcement of unprompted and prompted correct responses). This latter contingency should be used only when the teacher is certain that the student has acquired the target behavior, but for some reason resists making an unprompted correct response.

Summary

In summary, teaching students in small group instructional arrangements of three to five students with constant time delay can be a successful approach to providing instruction to students with a variety of handicapping conditions. The examples of instructional programs and the data sheets that are provided in this paper are based on actual instructional programs that have been successfully implemented by teachers. Thus, after some initial adaptation by the classroom teacher, these programs can be implemented successfully by most teachers.

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Table 1

Teacher Decisions for Small Group Instructional Programs

Component of Group Instruction	Teacher Decision
Select students	Identify homogeneous or heterogenous students.
Prerequisite skills	Identify students with good attendance, minimal disruptive behaviors, previous experience with systematic instruction and delay, reliable wait response, attending behaviors, work for 10-20 minute sessions.
Instructional trial sequence	Predictable or unpredictable.
Student responses	Individual or choral.
Identify task, select stimuli	Same task, same stimuli; different task, different stimuli; functional, chronologically age-appropriate.
Attention (individual)	General or specific attention responses.
Attention (group)	Independent, dependent, or interdependent.
Consequences for performance	Correct, incorrect, no-response.
Procedure	Constant time delay.
Controlling prompt	Verbal, model, gesture, physical.

(table continues)

Table 1 (continued)

Component of Group Instruction	Teacher Decision
Time delay interval	Specify time delay interval.
Number of zero-second sessions	Specify number of zero-second sessions.
Criterion	Individual, group, or both.

Figure Caption

Figure 1. Sample data sheet for a receptive language task conducted in a small group instructional arrangement. This data sheet uses Before and After columns to record student responding during a group instructional session when teaching a receptive task. Prior to the instructional session, the teacher would complete the situational information (e.g., teacher's name, session number, etc.). This would be followed by placing an "x" in the attending column when supplemental reinforcement for attending will be given to all students. The delay interval column will tell the amount of time between the task direction and prompt. The Sd column is the target object and Distractors indicate the choices that the student can select from. If the student responds correctly before the prompt, record a "+" in the Before column; an incorrect response before the prompt is recorded by placing a "-" in the Before column. If the student responds correctly after the prompt a "+" is placed in the After column; if an error is made after the prompt, the teacher records a "-" in the After column. If the student makes no response after the prompt, the teacher should record "o" in the After column. At the end of the session, each type of response would be counted and the percentage calculated.

Teacher ____________________ Date ____/____/____

Session Number ________________ Session Time _____:_____

Tr. #	Attn. Cue	Delay Interval	Student name: Carrie				Response		Student name: Jessica				Response		Student name: Maria				Response	
			Sd	Distractors			Bef	Aft	Sd	Distractors			Bef	Aft	Sd	Distractors			Bef	Aft
1			fork	cup	hat	bowl														
2	X								knife	coat	bowl	plate								
3															fork	cup	coat	plate		
4																				
5	X																			
6																				
etc																				
18																				
Total Number			Correct Bef			Correct Aft			Correct Bef			Correct Aft			Correct Bef			Correct Aft		
of Each Response			Errors Bef			Errors Aft			Errors Bef			Errors Aft			Errors Bef			Errors Aft		
Type						No Respon						No Respon						No Respon		
Total Percent			Correct Bef			Correct Aft			Correct Bef			Correct Aft			Correct Bef			Correct Aft		
of Each Response			Errors Bef			Errors Aft			Errors Bef			Errors Aft			Errors Bef			Errors Aft		
Type						No Respon						No Respon						No Respon		

Figure Caption

Figure 2. Sample data sheet for an expressive task (sight word reading) conducted in a small group instructional arrangement. This data sheet uses columns for each type of response that can occur during the instructional session. The teacher begins by recording the situational data (e.g., name, date, etc.). In addition, the teacher records the name of the stimulus and the student who will receive the trial in the order they will be presented. The teacher then places an "x" in the attending cue column indicating when supplemental reinforcement for attending during another student's instructional trial should be provided. Also, the teacher records the delay interval to be used on each trial. When a student responds during instruction the teacher would place a check in the appropriate "type of response" column. After the session the number of checks from each column would be summed and divided by the number of trials to determine the percentage of each type of response for each student.

Teacher ______________ Date ____________ Procedure ____________

Start Time _____:_____ Stop Time ____:____ Total Time ____:____

Task: ____

TRIAL	STUDENT	STIMULUS	Attn. Cue	Delay	TYPE OF RESPONSE				
					Unpro Corr.	Prom. Corr.	Unpro. Error	Prom. Error	No Resp.
1	John	EXIT							
2	Michael	PEPSI							
3	Sabrina	ENTER	X						
4	Cheryl	TELEPHONE							
5	Michael	EMERGENCY							
6	Sabrina	HOSPITAL							
7	Cheryl	PUSH	X						
8	John	FIRE							
9	Sabrina	PULL							
10	Cheryl	TELEPHONE							
etc.									
60	Michael	EMERGENCY	X						
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								

Figure Caption

Figure 3. Sample data sheet for chained task conducted in a small group instructional arrangement. Although the narrative describes teaching sandwich making using backward chaining, this particular data sheet can be used with forward chaining or total task presentation. The teacher initially completes the situational data at the top of the form followed by recording steps in the task analysis. The teacher then records the delay interval to be used for the steps in the task analysis. If using backward chaining, in the first session the teacher would simply model steps 1-24, record "0" in the delay column for step 25 and provide the controlling prompt for that step. This would be followed by recording the student response on step 25. If the student responds correctly before a prompt, a "+" is placed in the Before column. If the student responds correctly after the prompt, a "+" is placed in the After column. Incorrect responses before the prompt are recorded with a "-" in the Before column and errors after the prompt are recorded with a "-" in the After column. If the student makes a no-response after the prompt is delivered, the teacher places an "o" in the After column. At the end of each session, the teacher adds up the total number of each response type and calculates the percentage for each student in the group.

Teacher________________________ Date____________________

Session________________________ Time____________________

Steps in Task Analysis	Delay Interv.	Student Name: BILLY		Student Name: RALPH		Student Name: FREDDY	
		Before	After	Before	After	Before	After
1. Bread from cabinet							
2. Get meat, cheese, mayo							
3. Knife from drawer							
4. Open bread bag							
5. Remove 2 pieces							
6. Lay flat on counter							
7. Close bread bag							
8. Return to cabinet							
9. Open mayonnaise							
10. Dip knife in mayo							
etc.							
25. Knife in sink							
Summary Data	Corrects	#= %	#= %	#= %	#= %	#= %	#= %
	Incorrects	#= %	#= %	#= %	#= %	#= %	#= %
	No Resp.		#= %		#= %		#= %

Appendix D

Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Farmer, J. A. (1990). Use of constant time delay in small group instruction: A study of observational and incidental learning. Journal of Special Education, 23, 369-385.

USE OF CONSTANT TIME DELAY IN SMALL GROUP INSTRUCTION: A STUDY OF OBSERVATIONAL AND INCIDENTAL LEARNING

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This investigation examined the effectiveness and efficiency of constant time delay in small group instruction. Four secondary age students with mild and moderate mental retardation were taught to identify local and federal service and government agencies and over-the-counter medications. The amount of information learned when each subject was presented with two target and six observational stimuli (same-task, different-stimuli condition) was compared to when each student in the group was taught the same eight target stimuli (same task, same stimuli condition). The subjects' acquisition of incidental information presented in the descriptive praise statement following correct responses to the target stimuli was assessed. A multiple probe design across behaviors was used. The results indicated that (a) constant time delay was effective across all facts, students, and conditions; (b) the same-task, different-stimuli condition produced more efficient learning than the same-task, same-stimuli condition; (c) students acquired more target information in the same-task, same-stimuli condition; (d) observational learning occurred in the same-task, different stimuli condition for all subjects; (e) increased exposure to other students' target information and differential reinforcement in the probe conditions increased the percentages of correct observational responding in the same-task, different stimuli conditions; and (f) there were no differences between conditions in students' acquisition of incidental information. These findings are discussed in terms of strategies for designing effective and efficient small group instruction.

Instruction of students with moderate and severe handicaps requires careful analysis of the efficiency of the strategies used. In recent years, investigations have evaluated the use of errorless learning procedures in classroom settings. One such procedure, constant time delay, has been effective in teaching food preparation to moderately delayed adolescents (Schuster, Gast, Wolery, & Guiltinan, 1988), manual sign production to adolescents with severe mental retardation (Browder, Morris, & Snell, 1981), receptive identification of pictures and addition problems to an adolescent with moderate mental retardation (Johnson, 1977), and sight word reading to primary-age students with moderate developmental disabilities (Ault, Gast, & Wolery, 1988).

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Also, studies have compared the efficiency of constant time delay to that of other response prompting procedures on measures such as the number of trials, errors, and minutes of direct instructional time to criterion. It has been shown to be more efficient than the system of least prompts in teaching sight words to preschoolers with developmental delays (Doyle, Wolery, Gast, Ault, & Wiley, in press), grocery words to primary-age students with moderate handicaps (Gast, Ault, Wolery, Doyle, & Belanger, 1988), and manual signs to students with moderate to severe retardation (Bennett, Gast, Wolery, & Schuster, 1986). With these same measures, constant time delay was at least as efficient as progressive time delay (Ault et al., 1988).

Another means of increasing the efficiency of a procedure is to use group instruction. This instructional arrangement has been successful in teaching students with moderate handicaps a variety of behaviors (Browder, Hines, McCarthy, & Fees, 1984; Fink & Sandall, 1980; Orelove, 1982). Recent evidence suggests that constant time delay can be effective in small group arrangements with developmentally delayed preschoolers (Alig, Wolery, & Gast, in press; Schoen & Sivil, 1989) and secondary-age learning disabled students (Wolery, Alig, Gast, & Boyle-Gast, in press). An advantage of group instruction is the possibility of observational learning, including social as well as academic behaviors (Westling, Ferrell, & Swenson, 1982).

It seems appropriate that future instructional research should focus on the efficiency of small group arrangements. More specifically, a logical focus of such research should be on how group instructional procedures (turn taking, material presentation, attentional cues, prompting strategies, and consequent events) can be manipulated to facilitate observational learning. If an instructional program results in students' learning target behaviors in near errorless fashion, as well as other group members' target behaviors, then a truly efficient strategy has been identified. Although some students may acquire new behaviors simply by observing and imitating the performance of others without reinforcement (MacDonald, Dixon, & LeBlanc, 1986), other students may require additional manipulation of variables to ensure that observational learning occurs (Browder, Schoen, & Lentz, 1987). A challenge to current instructional strategies research is to identify those procedural variables that increase observational learning of all group members. In a recent study, for example, Wolery et al. (in press) used different attending cues to secure students' attention in small group instruction. Specific versus general attentional responses were compared to determine if the type of attentional response required of students would differentially affect the students' acquisition of target and observational information related to over-the-counter medications and local and government agencies. The results showed that requiring specific attentional responses facilitated the learning of other students' target behaviors. Schoen and Sivil (1989) taught pairs of preschoolers self help skills. In their investigation, one student in the dyad received direct instruction of the target behavior while the second student in the pair simply observed instruction. Results indicated that observational learning occurred in this condition for the students not directly taught.

Another index of efficiency is the extent to which incidental, related, but non-target, information is learned (Stevenson, 1972). Such information can be presented systematically in a number of ways, such as being a part of the attending cues, part of the prompt sequences, and part of the feedback statements. Recent research has begun to focus on this issue. For example, Alig et al. (in press) required preschoolers to repeat the teacher's spelling of a target sight word prior to reading the word aloud. Although correct spelling was not specifically reinforced, the results showed that the percentage of correct spelling for words taught with the specific attending response was greater than for words taught with a general attending response. Another method for presenting the incidental information is to select information related to the target behavior and to use it as a prompt. For example, Gast, Doyle, Wolery, Ault, and Farmer (in press) embedded incidental information in the prompt hierarchy of a system of least prompts procedure when teaching students with moderate handicaps to read recipe sight words. This resulted in students learning to identify information related to the recipe words such as the utensil used to perform the recipe word action. Another method for inserting incidental information during instruction is to systematically deliver it as part of the consequent events following correct performance of the target behavior. Doyle et al. (in press) presented the function of a sight word in the descriptive praise statement following correct responding, which resulted in increases in the students' ability to expressively identify the function when requested to do so by the investigator. In another study, Wolery et al. (in press) presented additional information about the target (over-the-counter medications and agencies) behaviors, in the praise statements following correct responses to the target stimuli. Their study showed that the students were able to learn some of the incidential information for both their target and observational facts when it was a part of the consequent event following correct responses.

The current investigation had three purposes: (a) to evaluate the effectiveness of a constant time delay procedure when used in a small group instructional arrangement; (b) to evaluate the extent to which students learn other group members' information through observation; and (c) to compare the acquisition of related but nontargeted information across two instructional conditions (i.e., same-task, same-stimuli and same-task, different-stimuli).

METHODS

Subjects and Setting

Four students enrolled in a self-contained classroom in a rural, public high school participated in the study. Prerequisite skills for participation included (a) intact auditory and visual systems (students consistently responded to auditory and visual stimuli with corrective appliances when necessary); (b) appropriate attending behaviors in a group (students sat and made eye contact with the teacher and materials for 20 minutes within a small group instructional arrangement); (c) verbal imitation (students orally imitated a verbal model); and (d) wait response (students could wait for a teacher-delivered prompt).

Terry, an 18-year, 2-month-old female, was able to follow simple instructions and work with minimal supervision at a local fast food restaurant, telephone her employer when she had to miss work, cash her paycheck, prepare simple meals, complete simple household chores, and shop for groceries with a printed list. Her full scale IQ score on the Wechsler Adult Intelligence Scale–Revised (WAIS-R) (Wechsler, 1981) was 61. Walt, a 17-year, 9-month-old male, was also employed at a local fast food restaurant. He was able to work with minimal supervision, read direction signs, count money, and cash checks. He could prepare simple meals at home and was able to play age-appropriate board games and to participate in other activities. Walt received a full scale IQ score of 55 on the Wechsler Intelligence Scale for Children–Revised (WISC-R) (Wechsler, 1974). Jake was a 16-year, 7-month-old male with an IQ score of 45 on the WISC-R. He could socialize with peers and take part in a variety of leisure activities such as board and card games. He was able to sweep and complete other custodial duties with simple directions, work for 2 hours, cash checks, count money, and read direction signs. Erin, a 17-year, 7-month-old female, was diagnosed as having Down syndrome. Her full scale IQ score on the WAIS-R was 56. She could prepare simple snacks with supervision, groom herself, complete household chores such as simple ironing, use the telephone, cross streets, locate basic food items in the grocery store by brand name, socialize appropriately with peers, and work for 1 hour with minimal supervision.

Instructional sessions were conducted by the classroom teacher in the subjects' (5.1-m × 5.2-m) self-contained classroom. All subjects were seated together at a (1.0-m × 3.0-m) table located in the back of the classroom. The instructor and students were arranged so that all stimulus cards and corresponding responses were visible and audible to all group members. Students not involved in the study participated in regular classroom activities with the classroom assistants.

Materials and Instructional Format

A total of 32 facts related to the function of local service agencies, federal service agencies, local and federal governments, and over-the-counter medications were selected. The classroom staff was given a list of information to ensure that target stimuli were not taught during classroom or community-based instructional activities. The questions that were asked of the student (e.g., "What agency gives you organized recreation activities?") were presented both orally and visually. Each question was printed in black uppercase and lowercase letters on (24.0-cm × 36.0-cm) cards. The incidental information for each question was written on the back of each card as a cue to the teacher. The tangible reinforcer selected for the students was money; pennies were presented for correct responses and deposited in each student's classroom bank account. Target stimuli, incidental information, and the order of instruction are presented in Table 1.

Experimental Design

A multiple probe (Tawney & Gast, 1984) design across behaviors, with reinforced probe conditions, was used to evaluate the effectiveness of the constant time delay procedure. Differential reinforcement of correct and incorrect responses on probe trials increased the probability that students would respond correctly during the probe condition and decreased the probability that probe data were a deflated

TABLE 1

STUDENTS, THE ORDER OF INSTRUCTION, DISCRIMINATIVE STIMULI, TARGET RESPONSES, AND INCIDENTAL INFORMATION

Condition, set, student	Target question	Target response	Incidental information
Same-task, different-stimuli			
Set 1	What government agency collects taxes?	Internal Revenue Service	Lawrence Gibbs is the Director
Terry	What agency gives counseling for family problems?	Comprehensive Care Center	They refer you to others for help.
Set 1	What agency gives you recreation activities?	The Y.M.C.A.	They help with exercise programs
Walt	What official is head of the federal government?	The President	The president is Ronald Reagan.
Set 1	What agency gives money for the public schools?	The Education Department	The director is William Bennett
Jake	What agency helps farmers and people who are hungry?	The Agriculture Department	The director is Richard Lyng
Set 1	What agency provides health education programs?	The Health Department	They will give physicals
Erin	What official is head of the state government?	The Governor	The governor is Wallace Wilkinson
Same-task, same-stimuli			
Set 2	What agency gives information about employment?	Dept. of Employment Services	They set up job interviews
All	What agency gives information about business?	The Better Business Bureau	They will listen to complaints
Students	What agency gives money for emergency expenses?	The Community Action Service	They find emergency homes
	What agency gives information about educational rights?	Protection and Advocacy	They help with guardianship
	What agency mails Social Security checks each month?	Health and Human Services Dept	The director is Dr. Otis Bowen
	What official helps make the laws in the state?	The State Representative	Our representative is Joe Barrows
	What agency improves working conditions?	The Labor Department	The director is William Brock
	What official is head of the city government?	The Mayor	The mayor is James Mason

(continued)

TABLE 1
(CONTINUED)

Condition, set, student	Target question	Target response	Incidental information
Same-task, different-stimuli			
Set 3	What drug will help indigestion?	Antacid.	Milk of Magnesia is an antacid
Terry	What drug will help itching of dandruff?	Coal tar shampoo	Tegrin is a coal tar shampoo
Set 3	What drug will help itching of poison ivy?	Calamine	Caladryl has calamine.
Walt	What drug will help coughing?	Suppressants	Pertussin is a cough suppressant
Set 3	What drug will stop nasal congestion?	Decongestants	Afrin is a decongestant.
Jake	What drug will heal acne or pimples?	Benzoyl peroxides	Oxy 10 has benzoyl peroxide
Set 3 Erin	What drug will reduce underarm wetness and bacteria?	Antiperspirants	Ban is an antiperspirant
	What drug will stop pain and fevers?	Aspirin	Bayer is an aspirin.
Same-task, same-stimuli			
Set 4	What drug will heal babies' diaper rash?	Zinc oxide	Desitin has zinc oxide.
All	What drug will heal a sore throat?	Benzocaine	Chloraseptic has benzocaine
Students	What drug will heal cuts, scrapes, and burns?	Antibiotic hydrocortisone	Cortaid has hydrocortisone
	What drug kills and stops the spreading of germs?	Antiseptics	Isopropyl alcohol is an antiseptic
	What drug stops allergies?	Antihistimines.	Dimetane is an antihistimine.
	What drug slows breathing and the heart?	Depressants.	Barbiturates are depressants
	What drug will help in case of poisoning?	Activated charcoal	Charcodate has activated charcoal
	What drug will remove warts?	Salicylic acid	Off-Ezy has salicylic acid

representation of students' abilities. In addition, reinforcement of correct responses minimized the differences between the probe and constant time delay instructional conditions, thereby permitting one to attribute changes in performance to the time delay procedure alone. Each of the 4 students was taught two facts (same-task, different-stimuli condition) or eight facts (same-task, same-stimuli condition) across four instructional sets of facts. Experimental conditions were implemented in the following sequence: probe all 32 target facts; teach two different stimuli to each member of the group; probe all 32 target facts; teach eight identical target stimuli to all members in the group; probe the 32 target facts; repeat this sequence until all target facts have been learned. The alternation of the two experimental conditions (same-task, same-stimuli and same-task, different-stimuli) across one set of target information permitted a simple comparison of each, relative to the amount of information learned. This design reduced the possibility of multiple treatment interference by separating the two instructional conditions in time. If, for example, the parallel treatments design (Gast & Wolery, 1988) had been used, students would have been learning 16 rather than 8 stimuli during the same time period. This might have slowed the rate of acquisition; therefore, a slow alternation of conditions was appropriate. As with any staggered comparison design, there was the potential for sequential confounding. Since all students were taught in the same small group it was not possible to counterbalance the order of the introduction of the two conditions across students.

Procedures

General Procedures. Each session in probe and instructional conditions consisted of 32 trials with a maximum length of 20 minutes. Probe sessions were conducted in a one-to-one arrangement. The small group instructional sessions occurred when at least 3 of the 4 students were present. Individual trials were presented to each student. Following each probe condition, students were taught targeted facts using a constant time delay (CTD) procedure. The 32 facts were divided into four sets of eight facts each. In order to assess students' observational learning during small group instruction, two instructional conditions were alternated across the four sets of target facts. In the same-task, same-stimuli condition, all 4 students were taught the same eight facts: one trial on each of the eight facts each session. In the same-task, different-stimuli condition, each student was randomly assigned two target facts; the remaining six facts were measures of observational learning that were assessed in probe conditions. Under this condition, students had four trials on each of their two target facts each session and no trials on the observational learning facts. During instruction, students did not receive more than two consecutive turns, and no facts were presented on more than two successive trials. A general group attending cue (e.g., "Everybody, look.") was presented prior to each trial. On the average of every third trial, students who were making eye contact with the teacher received descriptive praise and a penny. All students were required to look toward the stimulus prior to presentation of the target question (e.g., "What elected official is head of the federal government?"). All correct responding during probe and instructional conditions resulted in the delivery of descriptive praise, confirmation of the correct response (e.g., "That's right, the president is head of the federal government."), and a penny. During instruction, incidental information was presented immediately after the praise statement (e.g., "Ronald Reagan is the president."). The criterion was 100% correct responding by all members in the group on their targeted facts for one session when reinforced on a continuous reinforcement (CRF) schedule, followed by 100% correct group responding for two consecutive sessions when reinforced on an average of every third correct response (VR3) before moving to the probe condition.

Incidental Information Test Procedures. Students were tested on their acquisition of information related to each of the 32 facts, as shown in Table 1. The tests included (a) orally giving the fact when presented with the incidental information in a question format (e.g., the student says "Y.M.C.A." when asked, "What agency helps with exercise programs?"); and (b) orally providing the incidental information when presented with the target fact in a question format (e.g., the student says, "Exercise programs" when asked "What else does the Y.M.C.A. do?"). This information was assessed individually prior to Probe 1, following each instructional condition, and after the final probe, by one of the investigators. Each fact was tested at least twice in each assessment. Correct responses were reinforced on a CRF schedule and all incorrect responses were ignored.

Probe Procedures. Prior to beginning instruction, each subject received a minimum of three individual probe sessions on all 32 facts. A probe condition was repeated after the students met criterion on each of the four instructional sets. The purpose of the probe condition was to (a) establish preinstruction performance levels, (b) assess maintenance of previously taught facts, and (c) evaluate observational learning. Each trial consisted of the instructor placing the stimulus card on the table in front of the student, presenting the attending cue ("S, look here"), securing the student's attention, asking the target question, and allowing the student 4 seconds to respond. All correct responses were followed by the delivery of descriptive praise and a penny. All incorrect responses were ignored, followed by the teacher waiting a 3- to 5-sec intertrial interval.

Constant Time Delay (CTD) Procedure. Each of the four sets of facts was taught with a 0- to 4-sec constant time delay procedure. All instruction occurred in a small group arrangement. The controlling prompt for all students was the teacher stating the answer to the question. The initial session of each instructional condition used a 0-sec delay. The instructor provided the attending cue, ensured the attending response, presented the task question (e.g., "What elected official is head of the state government?"), and immediately delivered the controlling prompt (e.g., "The governor."). If the student correctly repeated the answer to the question, the teacher provided descriptive verbal praise ("Good, the governor is head of the state government"), the incidental information (e.g., "The governor of Kentucky is Wallace Wilkinson."), and a penny. After one session at the 0-sec delay, all subsequent sessions were conducted at a 4-sec delay (i.e., the teacher waited 4 seconds between the time she presented the question and delivered the controlling prompt). Correct responses before (unprompted corrects) and after (prompted corrects) the controlling prompt resulted in descriptive verbal praise, presentation of incidental information, and the delivery of a penny. Errors occurring before the model (unprompted incorrects) resulted in a mild verbal reprimand and an instruction to wait for the prompt (e.g., "No, wait."). If the subject emitted an error following delivery of the prompt (prompted incorrect) or made no response within 5 seconds after the teacher's model, the instructor removed the target stimulus, waited the intertrial interval, and initiated the next trial. Only unprompted corrects counted toward criterion. Students moved to the next probe condition when all four reached criterion on their target facts.

Review Trials. Beginning with instruction on the second set of target facts, each student received two daily review trials on previously learned facts. The procedure for conducting review trials was identical to that used in the probe condition with the exception that (a) each correct response was followed by the presentation of the incidental information and (b) all incorrect responses were followed by an error correction procedure consisting of a mild verbal reprimand and a vocal model of the correct responses.

Reliability

Dependent Measure Reliability Estimates. Reliability observations were conducted by a research associate twice weekly and at least once during each experimental condition on student responses to both the attending cue and task direction on each trial. A point-by-point method (number of agreements divided by number of agreements plus disagreements multiplied by 100) was used to calculate reliability.

Procedural Reliability Estimates. The instructor's fidelity with the procedures across both probe and small group instructional conditions also was assessed (Billingsley, White, & Munson, 1980). These measures included recording total session length, presenting the correct task card, delivering the attending cue, securing an attending response from all students, presenting the task question, waiting the specified prompt delay interval, delivering the appropriate consequent event, and waiting the specified intertrial interval. The instructor's behavior was observed and compared to a description of the experimental procedures. Because a stopwatch was thought to be cumbersome, the teacher's waiting the delay interval was synchronized with that of the reliability observer through repeated practice prior to beginning the investigation. As a result of the practice sessions, some 1-sec variation was likely. Procedural reliability estimates were calculated by dividing the number of actual instructor behaviors by the number of planned behaviors and multiplying by 100. Estimates were calculated at least once for each condition, on each of the above behaviors, for each student in the group.

RESULTS

Reliability

The mean percentage of agreement on student responding during probe conditions was 100% across all students and 99.8% (range = 95.8% to 100%) during instructional conditions. In the probe conditions, the mean percentage of agreement on procedural reliability was 100% on all behaviors except delivery of the correct consequent event (mean = 99.8%, range = 99.5% to 100%). In the CTD conditions, the mean percentage of agreement was 100% on all variables except presentation of the correct task card (mean = 99.6%, range = 96.9% to 100%), waiting the 4-sec prompt delay interval (mean = 99.6%, range = 96.9% to 100%), and delivering the correct consequent event (mean = 99.6%, range = 96.9% to 100%).

Effectiveness and Efficiency

The mean percentage of correct responses (unprompted and prompted) for all 4 students across experimental conditions is presented in Figure 1. Prior to instruction, the percentage of correct responses to all 32 facts was zero across all probe conditions for each student in the group. Introduction of the constant time delay procedure across sets of facts resulted in criterion level responding on all target facts for all students. No modifications to the CTD strategy were necessary. Criterion level responding on all target facts for all students was maintained across probe conditions. Each student was taught a total of four target facts in the same-task, different-stimuli conditions and 16 facts in the same-task, same-stimuli conditions.

Although students learned their target facts in each of the instructional conditions, the same-task, same-stimuli conditions in which students were directly taught eight facts per set required a total of 544 instructional trials to criterion compared to the same-task, different-stimuli conditions, in which students were taught two facts per set, which required 304 trials. Similarly, the amount of direct instructional time for the same-task, same-stimuli conditions required more than 7 hours of direct instruction compared to 2 hours and 27 minutes for the same-task, different stimuli conditions. Acquisition of target facts was accomplished in a near errorless fashion for all students (mean = 2.9%, range = 0% to 7.5%). Analysis of errors by condition showed a slightly higher percentage of errors for the same-task, same-stimuli condition (mean = 3.8%, range = 0% to 7.5%) compared to learning under the same-task, different-stimuli condition (mean = 1.3%, range = 0% to 5.3%). Table 2, which summarizes all efficiency measures across sets of facts by condition, shows a decrease in the number of trials and errors, percentage of errors, and instructional time across the two introductions of the same condition.

Observational Learning

In the same-task, different-stimuli condition, acquisition of other students' target facts occurred. A summary of the mean percentage of correct responding to all observational stimuli for students across sets of facts and assessment times is presented in Table 3. During Probe 1, the percentage of correct responding to

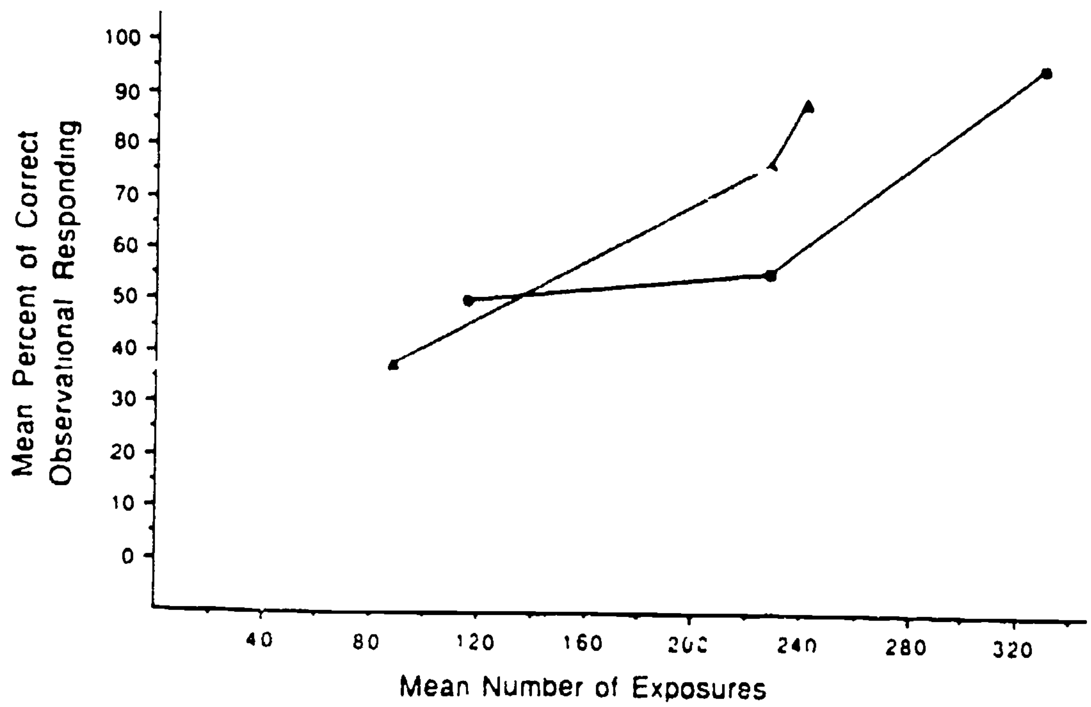

Figure 1. The mean percentages of unprompted and prompted correct responses using a constant time delay procedure for the group. Closed triangles indicate unprompted correct responses, and open circles indicate prompted corrects. The target facts in Sets 1 and 3 were taught in the same-task, different-stimuli condition and target facts from Sets 2 and 4 were taught in the same-task, same-stimuli condition.

all 12 observational stimuli (six per Set 1 and Set 3) was zero for all students. Some observational learning simultaneously occurred as students were learning their two target facts; however, performance improved with repeated exposure. An exposure was defined as hearing the correct response to other students' facts. An exposure included a correct response (a) emitted by a student during instruction or on a review trial, (b) delivered by the teacher when students waited for the prompt, and (c) modeled by the teacher as part of the error correction procedure on a review trial. Figure 2 shows how repeated exposure to Set 1 and Set 3 observational facts improved students' performance. In that correct responses to observational questions were reinforced during the probe condition, one cannot attribute the improvement to repeated exposure alone. The extent to which students learned the observational facts without reinforcement is reflected in the "to criterion" data presented in Table 3 (mean = 43.7%, range = 16.7% to 66.7%).

TABLE 2
SUMMARY OF EFFICIENCY MEASURES ACROSS STUDENTS AND INSTRUCTIONAL CONDITIONS TO CRITERION

Set condition	Number of target facts		Number of trials	Number of errors	Percentage of errors	Direct instructional time (min)
			Summary by Set			
Set 1		Total	168	3	1.7%	
Same-task,	2	Mean	42	.75	1.7%	83
different-stimuli		Range	16–56	0–3	0%–6.3%	
Set 2		Total	328	15	4.5%	
Same-task,	8	Mean	82	3.75	4.5%	278
same-stimuli		Range	24–176	0–6	0%–7.5%	
Set 3		Total	136	1	.7%	
Same-task,	2	Mean	34	.25	.7%	64
different-stimuli		Range	16–56	0–1	0%–3.1%	
Set 4		Total	216	6	2.7%	
Same-task,	8	Mean	54	1.5	2.7%	176
same-stimuli		Range	24–104	0–4	0%–3.8%	
			Summary by Conditions			
Sets 1, 3		Total	304	4	1.3%	
Same-task,	4	Mean	38	.5	1.3%	147
different-stimuli		Range	16–56	0–3	0%–6.3%	
Sets 2, 4		Total	544	21	3.8%	
Same-task,	16	Mean	68	2.6	3.8%	454
same-stimuli		Range	24–176	0–6	0%–7.5%	

Incidental Learning

The mean percentage of correct responses to incidental information for both target and observational facts is presented in Table 4. Students performed better when the incidental information was presented in a question format and they had to answer with the fact (Task A) than when they were presented with the fact and had to answer with the incidental information (Task B). This was consistent across all 4 students. Although students learned more incidental information for target facts, they did acquire some incidental information for observational facts, as shown in Table 4. No difference existed in the total amount of incidental information learned under the same-task, same-stimuli (mean = 74.4%, range = 25% to

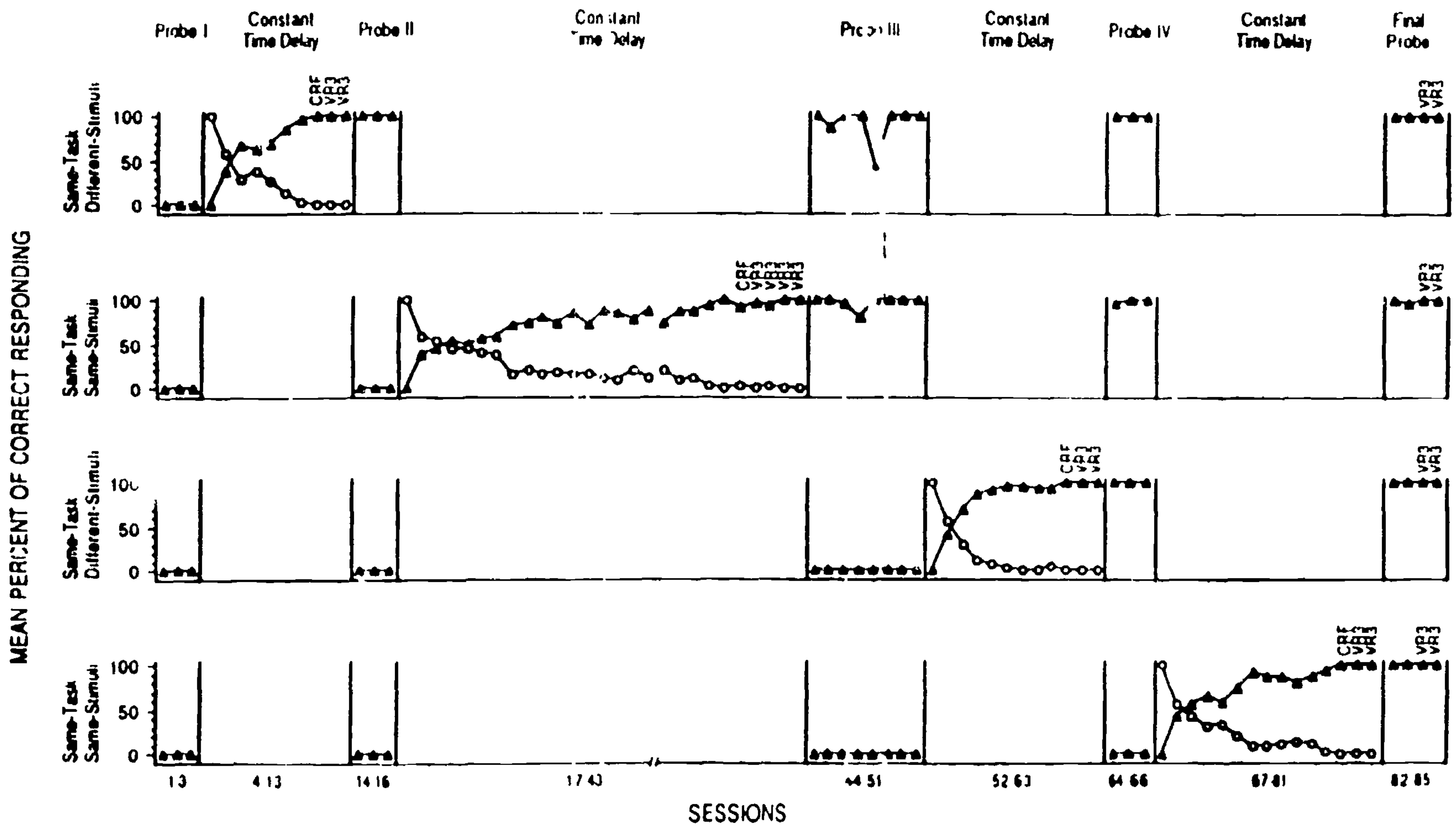

Figure 2. The mean percentages of correct observational responses when measured to criterion, through criterion, and in the final probe condition for the group. Closed circles indicate correct observational responses from Set 1 target facts in the first same-task, different-stimuli instructional condition and open triangles indicate correct observational responses on Set 3 target facts from the second same-task, different-stimuli condition.

TABLE 3
SUMMARY OF OBSERVATIONAL LEARNING FOR THE SAME-TASK, DIFFERENT-STIMULI CONDITIONS ACROSS SETS AND TIMES

Set		Probe I	To criterion	Through criterion	Final probe
Set 1					
	Mean	0%	50%	55.5%	95.8%
	Range	0%–0%	16.7%–66.7%	0%–77.8%	87.5%–100%
Set 3					
	Mean	0%	37.5%	76.3%	88.5%
	Range	0%–0%	16.7%–50%	55.5%–100%	66.7%–100%
Total Sets 1 & 3					
	Mean	0%	43.7%	65.9%	92.1%
	Range	0%–0%	16.7%–66.7%	0%–100%	66.7%–100%

TABLE 4
SUMMARY OF INCIDENTAL LEARNING FOR BOTH TARGET AND OBSERVATIONAL FACTS BY TASK

Condition		Incidental information			
		Target facts		Observational facts	
Set	Task A[a] Task B[b]	Mean	Range	Mean	Range
Same-task, different-stimuli					
Set 1	A	87.5%	50%–100%	70.8%	66.7%–83.3%
	B	87.5%	50%–100%	50%	16.7%–83.3%
Set 3	A	100%	100%–100%	83.3%	83.3%–83.3%
	B	75%	50%–100%	58.3%	33.3%–83.3%
Total Sets 1 & 3	A	93.7%	50%–100%	77.3%	66.7%–83.3%
	B	81.2%	50%–100%	54.1%	16.7%–83.3%
Same-task, same-stimuli					
Set 2	A	84.3%	75%–100%	Not applicable	
	B	75%	50%–100%		
Set 4	A	87.5%	75%–100%	Not applicable	
	B	50%	25%–75%		
Total Sets 2 & 4	A	85.9%	75%–100%	Not applicable	
	B	62.5%	75%–100%		

[a]Task A—oral labeling of the target response when presented with the incidental information.
[b]Task B—oral labeling of the incidental information when presented with the target response.

100%) compared to the same-task, different-stimuli conditions (mean = 76.7%, range = 33.9% to 100%).

DISCUSSION

This investigation taught facts related to the function of local and federal service agencies, local and federal governments, and over-the-counter medications in a small group instructional arrangement using a constant time delay procedure. From this study five results are apparent. First, the constant time delay procedure was reliably implemented in a small group instructional arrangement. The mean procedural reliability estimates were above 95%. Second, the constant time delay procedure was an effective strategy in teaching all students all targeted facts. This replicates earlier findings with preschool students (Alig et al., in press) and secondary students with learning disabilities (Wolery et al., in press). In addition, it extends to small group instructional arrangements previous research demonstrating the effectiveness of constant time delay procedures in one-to-one instructional arrangements (Ault et al., 1988; Doyle et al., in press; Gast et al., 1988). Third, all students learned some information through observation during the same-task, different stimulus condition, but no student learned all eight facts during initial instruction. However, through exposure to the words during review trials and reinforced probes, 2 students were able to learn all eight responses. An analysis of observational learning showed that no student had a preference for another student's set of facts. The analysis did show that with repeated exposure and differential reinforcement, students consistently improved their performance on observational stimuli. More specifically, the mean number of facts learned through observation at the point students reached their individual criterion was 2.6 (range = 1 to 4), compared to 4.2 (range = 0 to 6) at the group criterion, and 5.5 (range = 4 to 6) during the final probe condition. Upon comparison of the final probe data, students learned fewer facts under the same-task, different-stimuli condition (mean = 15, range = 14 to 16) than they did under the same-task, same-stimuli condition (mean = 16).

Fourth, although students learned more facts under the same-task, same-stimuli condition, the same-task, different-stimuli condition was more efficient in terms of trials, direct instructional time, and errors to criterion. The decision as to which condition a teacher might select should take into consideration the importance of the information being taught and the effects errors have previously had on students' behavior. If the behaviors to be taught are important to all group members, it is recommended that all information be targeted for direct instruction for all students in the group rather than relying on observational learning. It is also recommended that new sets of facts be introduced to students as they reach their individual criterion. In the present study, students received overlearning trials on their set of facts until all students reached criterion. The group criterion was used to facilitate observational learning and to simplify the procedures for the instructor. It permitted students the opportunity to focus on other students' facts after they learned their own, and it prevented the teacher from having different students under different conditions (e.g., 0-sec delay, 4-sec delay CRF, 4-sec delay VR3) during the same instructional session. Although procedurally more complex for the teacher, allowing students to move at their own pace may be more efficient in terms of the amount of information that can be taught during a set time period (Wolery, Ault, Gast, Doyle, & Mills, in press). Fifth, students learned incidental information that was presented by the teacher in the verbal praise statements following correct responses to the target task, although there were no programmed consequences for performance. Based on these data and those of previous investigations (Alig et al., in press; Doyle et al., in press; Wolery et al., in press) it is recommended that teachers add information related to the target task to their verbal praise statements following correct responding by their students. The acquisition of such information adds to the efficiency of instruction.

In summary, the constant time delay procedure was effective in teaching students with moderate mental retardation in a small group instructional arrangement. In addition to learning their target facts, students also learned other students' target facts through observation. Incidental information about these facts was also learned by being embedded in the consequent event following correct responding. Future research should address variables that might improve the effectiveness and efficiency of small group instruction. Specifically, investigators need to focus on the use of various types of stimulus and response prompting strategies, the effects of homogeneous and heterogeneous grouping, and strategies for facilitating observational and incidental learning.

Authors' Notes

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Appendix E

Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Martin, C. P. (1990). Comparison of predictable and unpredictable trial sequences during small group instruction. Learning Disability Quarterly, 13, 12-29.

COMPARISON OF PREDICTABLE AND UNPREDICTABLE TRIAL SEQUENCES DURING SMALL-GROUP INSTRUCTION

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Abstract. **The use of predictable (round robin) and unpredictable (random) trial sequences during small-group instruction was evaluated in three experiments in teaching word and abbreviation identification to four students with learning disabilities; a fifth student participated in part of Experiment I before moving to another school. In Experiment I, a progressive time-delay procedure was used to teach word reading in a small group, and the effects of a single-trial, predictable sequence was compared to a single-trial, unpredictable sequence. In Experiment II, a progressive time-delay procedure also was used to teach abbreviation identification in a small group, and the effects of a multiple-trial, predictable sequence was compared to a multiple-trial, unpredictable sequence. In Experiment III, a model-test procedure was used in a small group, and the effects of the multiple-trial, predictable sequence was compared to the single-trial, unpredictable sequence. An adapted alternating-treatments design was used in all experiments. Results indicate that the progressive time-delay procedure was reliably implemented and was effective in establishing criterion-level responding by all group members. Students also learned words taught to other students through observation. In Experiment I, the two trial sequences did not differ substantially, and in Experiment II mixed effects were found. With the model-test procedure in Experiment III, two students initially produced higher levels of correct responding in the multiple-trial, predictable sequence; however, no substantial differences were found in observational learning. Across all investigations, no consistent effects of the trial presentation methods were noted.**

Several effective instructional procedures exist for teaching students with handicaps including progressive and constant time delay (Handen & Zane, 1987), the system of least prompts (Doyle, Wolery, Ault, & Gast, 1988), most-to-least prompting, and integrated prompting strategies (Schoen, 1986). The literature comparing the efficiency of these procedures is developing (Ault, Wolery, Doyle, & Gast, 1989). For example, the progressive time-delay procedure appears to be as efficient as the constant time-delay procedure with students who have moderate retardation (Ault, Gast, & Wolery, 1988), and more efficient with such students than the system of least prompts

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(Bennett, Gast, Wolery, & Schuster, 1986; Godby, Gast, & Wolery, 1987). Much of this research, however, has been conducted in 1:1 instructional arrangements. Another body of research clearly indicates that students, even those with severe handicaps, can learn in small groups (Reid & Favell, 1984).

Small-group instruction is advocated as a means of (a) increasing access to less restrictive settings (Fink & Sandall, 1978), (b) facilitating generalization (Koegel & Rincover, 1974), (c) providing a context for peer interactions (Alberto, Jobes, Sizemore, & Doran, 1980), (d) promoting observational learning, (e) enhancing student motivation (Brown, Holvoet, Guess, & Mulligan, 1980), (f) using teacher time efficiently (Westling, Ferrell, & Swenson, 1982), and (g) increasing access to natural reinforcement conditions (turn-taking, obtaining turns contingently, waiting for attention, tolerating intermittent attention, and receiving reinforcement from peers as well as adults) (Snell & Zirpoli, 1987). Despite these potential benefits, research is needed on how to organize and implement small-group instruction.

When planning to teach students in a small-group arrangement, teachers make several decisions. Some of these decisions include whether students of different ability should be taught in the same group, whether students should be taught the same or different behaviors, whether students should respond chorally or individually, whether interactions between students should be promoted, how inappropriate or inattentive behaviors should be controlled, and many others. If students are to respond individually rather than chorally, the teacher must decide how the trials are to be presented: in a predictable, round-robin fashion or in an unpredictable or random sequence. No research was found that addressed this issue; however, some related findings suggest that unpredictable trial presentation should be used. For example, distributed trial presentation is seen as "best practice" when teaching students with severe handicaps (Guess & Helmstetter, 1986). Further, a substantial body of literature is developing that supports varied task presentation. Using varied tasks appears to facilitate skill acquisition and generalization (Dunlap, 1984; Neef, Iwata, & Page, 1980) while reducing off-task behavior (Dunlap, 1984) and aberrant behavior (Winterling, Dunlap, & O'Neill, 1987).

The purposes of this study were (a) to evaluate the progressive time-delay procedure in a small group and (b) to compare the effects of predictable and unpredictable trial presentations in small-group instruction on skill acquisition, attention to tasks, and observational learning. A twofold rationale exists for these purposes. First, few studies have investigated the application of efficient, errorless learning procedures in the context of small groups. Given their rich history in 1:1 instruction, applications in small groups might increase the efficiency of small-group instruction and open such instruction to students who otherwise would require 1:1 arrangements. Second, although small-group arrangements are frequently used, relatively little research has explored ways to implement such teaching. Thus, investigating the relative merit of predictable or unpredictable trial sequences would extend the current knowledge on how to implement small-group instruction.

EXPERIMENT I

METHODS

Participants and Setting

Subjects were five children (3 males and 2 females), ranging in age from 8 years 9 months to 10 years 10 months, who were enrolled in public school regular and special education classes. All children were served in two special education resource rooms for students with learning disabilities, behavior disorders, and mild mental retardation. All met the following prerequisite skills: normal visual and auditory functioning with or without appliances as well as the ability to (a) work in small groups for 15 min, (b) wait 8 sec for a prompt from the teacher, (c) pronounce target words accurately, and (d) respond correctly to "What word?" when shown known words. (The students are described in Table 1. One student, Mason, moved before the study was completed.)

Sessions were conducted by one of the two resource-room teachers (fifth author) in her classroom (6.4 X 8.5 m) at a kidney-shaped table (1.8 X 1 m). The teacher was seated on one side of the table with the children on the other so they could see the stimuli and hear the instructions; students sat in the same seat each day. Other students were involved in individual work activities during experimental sessions.

Materials

From a second-grade basal reader, 50 target words were selected and hand printed in lower-case letters in black ink on white cards (7.6 X 12.7 cm).

Table 1
Description of Students and List of Target Stimuli

Student Name	Gender	Age	Grade	Target Words: Predictable Trial Sequence	Target Words: Unpredictable Trial Sequence	Diagnosis and Description of Test Results
Hank	Male	10 yr 10 mo	4th	daughter syllable though quiet whole	because caught neighborhood owned tiny	"Mildly characteristic of learning disability"; Full-scale IQ = 90 (WISC-R); Word-recognition grade level = 2.4 on *Brigance Diagnostic Inventory of Basic Skills* (BDIBS) (Brigance, 1977)
Alice	Female	9 yr 2 mo	3rd	busy sudden touched usually written	answer brought figure later probably	Learning disability; Full-scale IQ = 118 (WISC-R); Word-recognition grade level = 1.8 on BDIBS; Overall grade level = 2.6 on *Peabody Individual Achievement Test* (PIAT) (Dunn & Markwardt, 1970)
Frank	Male	9 yr 4 mo	3rd	between earth leaned straight trouble	bought crowd few solved teams	Attention-deficit disorder and learning disability; Full-scale IQ = [illegible]02 (WISC-R); Oral reading level less than primer on BDIBS; Reading age of 6 yrs 6 mos on *The Test of Early Reading Ability* (Reid, Hresko, & Hammill, 1981)
Nellie	Female	9 yr 5 mo	4th	enough subtraction through quickly wire	able change directions instead join	Learning disability; Full-scale IQ = 100 (WISC-R); Word-recognition grade level = 1.5 on BDIBS; Overall grade level = 2.2 on PIAT
Mason	Male	8 yr 8 mo	3rd	causes example travel quite weigh	behind course easy suppose thousand	Learning disabilities; Test results not available

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Pennies were used as tokens which could be exchanged for a variety of back-up reinforcers (pencils, notepads, candy).

Procedures

General procedures. One small-group instructional session occurred each school day if at least three students were present. The group was characterized by several factors: (a) all students were taught words but each student learned different words (i.e., to assess observational learning); (b) students responded individually rather than chorally; (c) each student received an equal number of trials (15 per session); (d) a progressive time-delay procedure was used to teach all students; and (e) the trial sequences (predictable and unpredictable) were randomly alternated across days. Ten different words were targeted for each student — five with the predictable and five with the unpredictable condition. Words were assigned to the two conditions to minimize differences in difficulty. That is, all words were at the second-grade level and each condition contained words that had a similar number of syllables and that began with different initial letters. Words assigned to each student are shown in Table 1; other subjects' words served as observational learning words.

Predictable and unpredictable trial sequence conditions. In predictable sessions, the teacher began by providing one trial to the student on her left followed by a trial to the student seated next to the first child, and so on in order around the table. This left-to-right sequence continued until the end of the session. In the unpredictable sessions, however, the teacher delivered trials to students in random order with each student receiving no more than two trials in a row.

Baseline. Prior to instruction, one-to-one daily sessions were conducted with each student to assess his/her performance on all words in the study (individual target words and other students' words) for a minimum of three days or until stable performance was evident. These sessions consisted of 55 trials, 1 trial on each of the student's 10 target words, 1 trial on each of the other students' target words (40 observational learning words), and 1 trial on each of 5 known words (included to ensure reinforcement for correct responding during baseline sessions).

During baseline, the teacher: Held up the word card and said, "(name), look."; ensured that the student looked; said, "What word?"; waited 3 sec for a response (teacher silently counted "1001, 1002, 1003"); provided appropriate consequences; and recorded the trial during a 2-5 sec intertrial interval. Responses were scored as (a) *correct* — student said the word within 3 sec of "What word?"; (b) *incorrect* — student said any word other than the correct one within 3 sec of "What word?"; or (c) *no response* — student said nothing within 3 sec of "What word?". For correct responses, the teacher said, "Good.", repeated the word, and delivered one token to the student. For incorrect or no responses, the teacher removed the word card and initiated the intertrial interval. Correct responses were reinforced during baseline to ensure that any behavior change was a result of the intervention alone, not reinforcement and the intervention. Students were also reinforced for looking at the cards on the average of every 10 trials to maintain attention. At the end of each session, students exchanged tokens for back-up reinforcers (pencils, candy, etc.).

Progressive time delay. Each time-delay instructional session occurred in a small group and included 75 trials, 15 for each student. These 75 trials were divided into three blocks of 25 so that students received one trial on each of their five words before any of the words were repeated. The controlling prompt in the time-delay procedure was the teacher's vocal model of the target word. In the first instructional session within each condition, the teacher presented the first 25-trial block with a 0-sec prompt-delay interval. The teacher held up the card and said, "Everyone, look." She then said the target student's name, ensured that the student was looking, asked, "What word?", and immediately said the word name. Correct imitations of the model were reinforced. On the second 25-trial block, the teacher waited 1 sec after asking, "What word?", before modeling the word name. The response interval was increased by 1 sec on each successive 25-trial block to a maximum of 8 sec.

During instruction, five potential responses were recorded. *Unprompted correct* responses: when the student stated the word correctly before the teacher modeled the correct response; *prompted correct* responses: when the student correctly imitated the teacher's model; *non-wait errors*: when the student said any word other than the correct one before the teacher's model; *wait errors*: when the student said any word other than the correct one after the teacher's model; and *no responses*: when the student did not say any word within 5 sec of the model. For correct responses, the teacher said, "Good," repeated the word, gave one token to the student, and initiated the 2-5 sec intertrial interval. Only unprompted correct responses counted toward criterion. For non-wait and wait errors, the teacher said, "Wait if you don't know," removed the card, and initiated the intertrial interval. For no responses, the teacher removed the card and initiated the intertrial interval. When students had accumulated 13 of 15 possible tokens, they exchanged them for one back-up reinforcer at the end of the session. If they did not have 13, they could save any tokens they had earned. Criterion was 100% unprompted correct responses for one session on a continuous reinforcement schedule (CRF) followed by a group criterion of 100% unprompted correct responses for two consecutive sessions on a variable ratio-three schedule (VR3). When individual group members met the CRF criterion, that student was placed on a VR3 schedule until all members of the group had met criterion.

Group-management contingency. To ensure that students responded only when it was their turn, the following contingencies were used. The first time a student said another's word, a warning was given. The second time this happened within a given session, the teacher took one token away from the violator, but let the student keep any remaining tokens. However, the student was not allowed to select a back-up reinforcer that session. The third violation resulted in removal of all tokens, and the student was asked to leave the group. Any time another student interrupted a trial, it was delivered to the target student at the end of the session.

Measurement of responses to attentional cue. In both predictable and unpredictable conditions, students' responses to the attentional cue, "Everybody look," were recorded by an observer. When the teacher provided the cue, the observer glanced from left to right at the eyes of the first three students. They were scored as *attending* — eyes looking at the card or the student who was answering — or *nonattending* — eyes directed at anything other than the card or the answering student. On the next trial, the observer measured the remaining student in the group.

Measurement of observational learning. During instruction, students were able to observe 40 words being taught to other members of the group. Their ability to read these words was measured (a) during the baseline condition, (b) when each student individually met the CRF criterion, and (c) when the group VR3 criterion was met. All assessments occurred in 1:1 arrangements, with the latter two conducted by the research associate to assess generalization. The assessor held up the word card, said "What word?", and waited 3 sec for a response. Descriptive praise was provided for correct responses; for errors and no responses, the card was removed and the intertrial interval was initiated.

Experimental Design

An adapted alternating-treatments design (Sindelar, Rosenberg, & Wilson, 1985) was used to compare the effects of the predictable and unpredictable trial sequences. This design is similar to the alternating-treatments design in that two or more treatments are applied in alternating fashion across experimental sessions (days). However, rather than applying the compared treatments to the same behavior, they are applied to different, but equally difficult, independent behaviors (two sets of second-grade level words with an equal number of syllables). After the baseline condition, students learned one group of words using the predictable trial sequence, the other with the unpredictable sequence. The use of these conditions was randomly assigned to days, with no more than three consecutive days in the same condition.

Reliability

Reliability assessments on student responding (to the attention cue and task direction) and procedural fidelity (Billingsley, White, & Munson, 1980) were conducted at least once during the baseline condition and at least once every five days for each experimental condition. For procedural reliability, the following behaviors were measured: presenting the correct card to the correct student; presenting the attention cue and ensuring a response; saying "What word?"; waiting the correct response interval; providing the prompt when appropriate; providing the correct consequences, and waiting the intertrial interval.

RESULTS

Reliability Estimates

Reliability estimates were calculated using the point-by-point method (the number of agreements divided by the number of agreements plus disagreements multiplied by 100). The percent agreement on student responding during baseline condition was 96.3, 95.1, 98.7, 99.3, 98.7 for Hank, Mason. Alice. Frank. and Nellie. respectively. In group instruction. agreement was 100% for all students in predictable sessions and 99.6% in unpredictable sessions. Percent of agreement on students' responses to the attentional cue was 83 (range 80-87), 92 (range 89-97), 83 (range 80-86). 83 (range 80-86). and 91 (range 83-100). respectively, for Hank, Mason, Alice, Frank, and Nellie. Procedural reliability was calculated by dividing the number of actual teacher behaviors by the number of planned behaviors and multiplying by 100 (Billingsley et al., 1980). Mean estimate for the teacher behaviors during baseline condition was 99.5 (range 98.9-100); in the predictable condition it was 99.4 (range 98.2-100); and in the unpredictable condition it was 99.4 (range 97.3-100). Procedural errors were distributed across behaviors.

Effectiveness and Efficiency

The percent of correct responses is shown in Figure 1. For all subjects, correct responding for both predictable and unpredictable words in the baseline condition was 0%. With the introduction of the progressive time-delay procedure, all subjects reached criterion on both predictable and un-

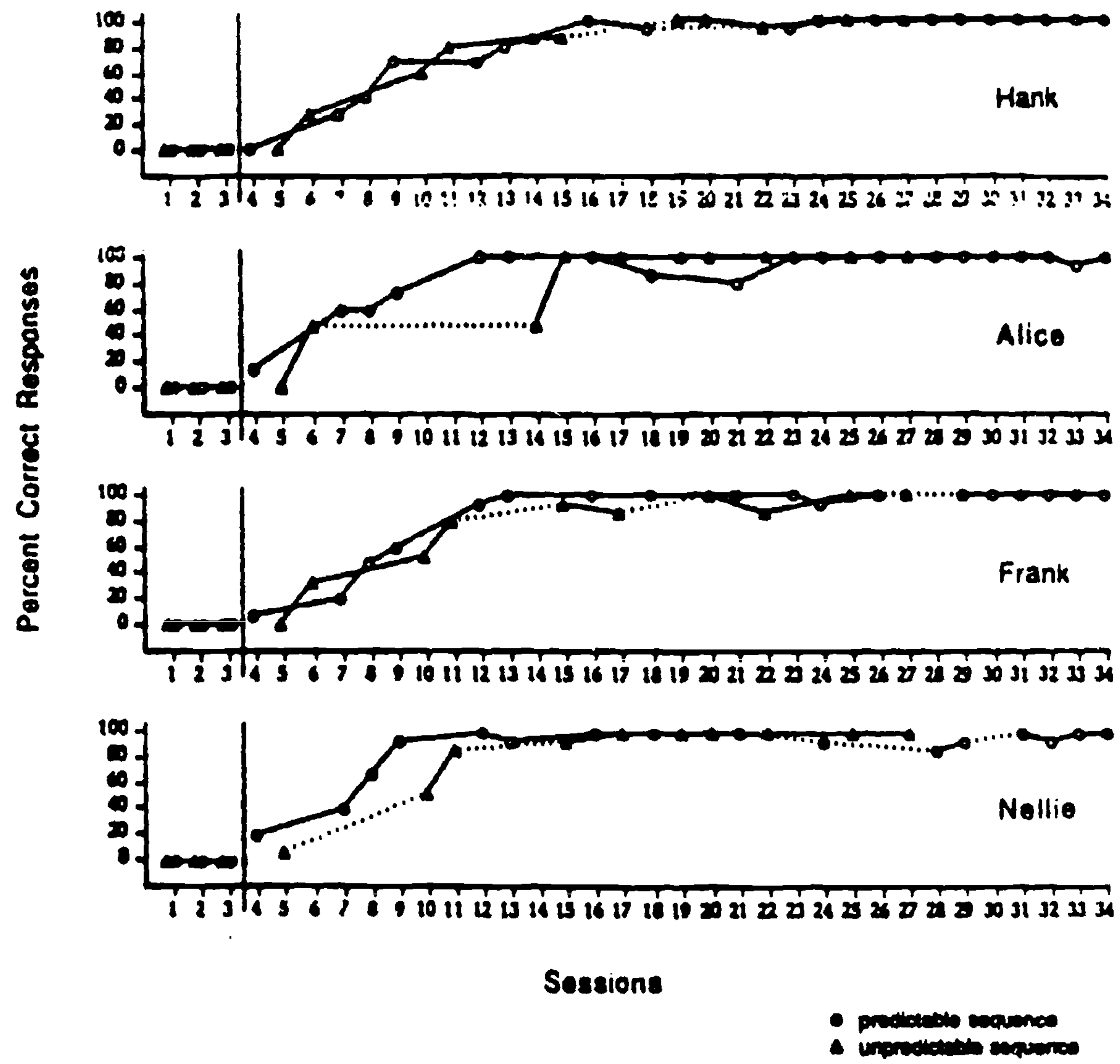

Figure 1. Percent of correct responses for each student when taught with a progressive time-delay procedure in single-trial, predictable sequence and single-trial, unpredictable sequence for Experiment I. Broken lines between data points indicate student absences.

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Table 2
Percent of Correct Responses and Percent of Net Gain on Observational Words for Experiment I

Student Condition	Baseline[a]	CRF Criterion	VR3 Criterion	Percent Net Gain from Baseline to CRF Criterion	Percent Net Gain from Baseline to VR3 Criterion
Hank					
Predictable	23	80	85	57	62
Unpredictable	27	85	85	58	58
Alice					
Predictable	7	65	70	58	63
Unpredictable	0	50	40	50	40
Frank					
Predictable	2	35	60	33	58
Unpredictable	7	35	35	28	28
Nellie					
Predictable	5	[illegible]	65	50	60
Unpredictable	3	60	70	57	67

[a]Baseline percentages represent a mean percent of correct responses across three baseline sessions.

predictable words. Thus, the time-delay procedure was effective in teaching students the target words regardless of the trial presentation sequence used. One instructional modification was made on the last day of the predictable condition. Because students were reinforced on a VR3 schedule, they could earn back-up reinforcers without performing at 100% unprompted correct responses. The teacher told them before the session that all their responses must be correct to earn a back-up reinforcer. As a result of this modification, all students emitted 100% correct unprompted responses.

Number of sessions and percent of errors to criterion were calculated for the predictable and unpredictable conditions to determine whether either condition resulted in more efficient learning. Data on sessions to criterion were based on the first instructional session until each student met the CRF criterion. Mason was not included in this analysis as he moved before meeting criterion. In the predictable condition, Hank required 7 sessions, Alice 5, Frank 6, and Nellie 5; in the unpredictable condition, Hank required 7, Alice 4, Frank 7, and Nellie 5. The percent of errors in both conditions was low — 3% in the predictable condition and 2% in the unpredictable condition. Overall, neither trial-presentation condition appeared more efficient than the other.

Observational Learning

The percent of words students learned through observation is presented by condition in Table 2. As shown, all students learned some words taught to other students in both conditions. The greater amount of observational learning appeared to occur from baseline to CRF criterion rather than from CRF to VR3 criterion. For Hank and Nellie, the differences were minimal between the predictable and unpredictable conditions, but Alice and Frank appeared to learn more words taught in the predictable than the unpredictable condition.

Attention Data

Data on the mean percent of trials in which students attended to the attentional cue were collected in 63% of the predictable and 83% of the unpredictable sessions. As presented in Table 3, minimal differences appeared between conditions.

DISCUSSION

According to the results from Experiment I, no substantial differences existed between the predictable and unpredictable conditions. Experiment II was implemented to increase the differences in the two conditions. Specifically, its purpose was to compare a multiple-trial, predictable sequence with a single-trial, unpredictable sequence on acquisition, attention, and observational learning. The multiple-trial, predictable sequence was similar to the predictable sequence in Experiment I except that students received four trials rather than one during each turn. The single-trial, unpredictable condition was identical to the unpredictable condition in Experiment I.

EXPERIMENT II

METHODS

Participants and Setting

Four participants of Experiment I — Hank, Alice, Frank, and Nellie — also participated in Experiment II, and the settings were identical.

Materials and Tasks

From the school district's curriculum, 32 abbreviations were selected. Each student was taught eight abbreviations, four in each condition. Other materials, tokens, and back-up reinforcers were identical to those described in Experiment I.

Procedures

General procedures. As in Experiment I, one small-group instructional session was held each school day, and the abbreviations were taught using the progressive time-delay procedure. Two instructional conditions were randomly alternated across days — students learned four abbreviations with the multiple-trial, predictable sequence and four with the single-trial, unpredictable sequence. Other subjects' target abbreviations served as observational learning stimuli. Abbreviations were assigned to the two conditions so that abbreviations learned in one condition were of the approximate difficulty as those learned in the other, based on length, use of upper- and lower-case letters, and beginning letters. In the multiple-trial, predictable condition, Hank was taught M.D., Rd., in., qt.; Alice was taught yd., sec., Govt., Inc.; Frank was taught No., hr., tsp., gal.; and Nellie was taught P.O., Co., lb., Dept. For the single-trial, unpredictable condition, Hank was taught Jr., Ave., Mt., tbsp.; Alice was taught Ms., Capt., doz., mi.; Frank was taught mo., P.M., oz., wk.; and Nellie was

Table 3

Percent of Correct Responses to the Attention Cue for All Subjects for Both Conditions Across the Three Experiments

Subject	Experiment[a]					
	Experiment I		Experiment II		Experiment III	
	Predict.	Unpredict.	Predict.	Unpredict.	Predict.	Unpredict.
Hank	75	81	51	54	73	72
Alice	75	76	59	44	70	58
Frank	79	84	79	70	85	90
Nellie	86	86	76	66	75	81

[a]Experiment I used progressive time delay and compared single-trial, predictable to single-trial, unpredictable trial sequences; Experiment II used progressive time delay and compared multiple-trial, predictable to single-trial, unpredictable trial sequences; and Experiment III used a model-test procedure and compared multiple-trial, predictable to single-trial, unpredictable trial sequences.

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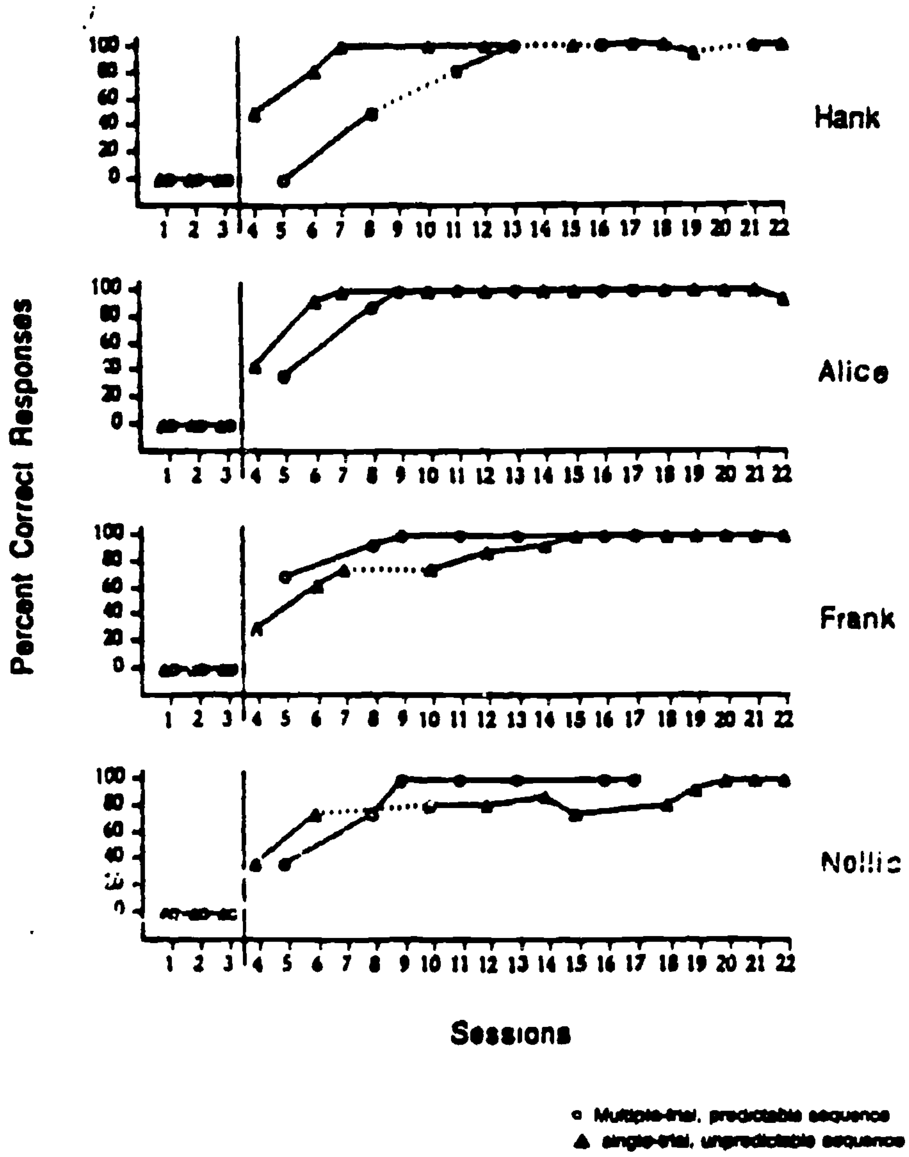

Figure 2. Percent of correct responses for each student when taught with a progressive time-delay procedure in multiple-trial, predictable sequence and multiple-trial, unpredictable sequence for Experiment II. Broken lines between data points indicate student absences.

taught A.M., pt., Bldg., and Sr. Procedures for collecting attention data, observational learning data, and reliability assessments were identical to those used in Experiment I. In addition, the same group-management contingency was in effect.

Multiple-trial, predictable sequence and single-trial, unpredictable sequence conditions. During multiple-trial, predictable sequence sessions, the teacher provided four consecutive trials — one trial on each of the four target abbreviations — to the student on her left, followed by the same number of trials to the student seated next to the first student, and so on until all students had received four consecutive trials. This pattern was repeated until all trials had been presented. The single-trial, unpredictable sequence sessions were conducted as in Experiment I. Before each session, the teacher told the group which condition was in effect.

Baseline conditions. Prior to instruction, all 32 abbreviations plus 5 known words or abbreviations were presented in 37 trial sessions. Baseline sessions were conducted for a minimum of three days or until stable performance was evident. Procedures were identical to those used in Experiment I.

Progressive time-delay procedures. As in Experiment I, the progressive time-delay procedure was used. During each session, students received four trials on each of their four abbreviations. Sessions were divided into four, 16-trial blocks for a total of 64 trials. All other procedures were identical to those described for Experiment I.

Experimental Design

As in Experiment I, an adapted alternating-treatments design was used to compare the effects of the multiple-trial, predictable sequence and the single-trial, unpredictable sequence. The use of each condition was randomly assigned to days with no more than two consecutive days of the same condition.

RESULTS

Reliability Estimates

Reliability estimates were calculated using the point-by-point method. Percent agreement on student responding during baseline was 96.2, 100, 100, and 96.2 for Hank, Alice, Frank, and Nellie, respectively. Mean percent agreement during the multiple-trial, predictable sequence was 100 and 98.4 (range 97.5-99.3) during the single-trial, unpredictable sequence. For students' responses to the attentional cue, the mean percentage of agreement was 86 (range 83-90). Procedural reliability estimates were calculated as in Experiment I. Mean estimates for all teacher behaviors were 99.4 (97.9-100) in baseline, 95.7 (70.5-100) in the multiple-trial, predictable condition, and 98.9 (97.5-99.3) in the single-trial, unpredictable condition.

Effectiveness and Efficiency

The percent of correct responses for all subjects is shown in Figure 2. As illustrated, the progressive time-delay procedure was effective in establishing criterion-level performance with all students on all abbreviations regardless of the trial sequence used. No procedural modifications were necessary.

The number of sessions and the percent of errors to criterion also were calculated for the multiple-trial, predictable and the single-trial, unpredictable conditions to determine whether one resulted in more efficient learning. Data on sessions to criterion were based on the first instructional session until each student met the CRF criterion. In the multiple-trial, predictable condition, Hank required 4 sessions, Alice 3, Frank 3, and Nellie 3; in the single-trial, unpredictable condition, Hank required 3, Alice 3, Frank 7, and Nellie 9. These data appear to indicate that the sequence of trial presentation did not influence learning for Hank and Alice. However, for the single-trial, unpredictable condition Frank and Nellie required more than double the number of sessions needed in the multiple-trial, predictable condition. As in Experiment I, the percent of errors in both conditions was low: 1% in the multiple-trial, predictable condition and 3% in the single-trial, unpredictable condition. Thus, for sessions to criterion and for two students — Frank and Nellie — the multiple-trial, predictable condition resulted in more rapid learning.

Observational Learning

The percent of words students learned observationally by condition is presented in Table 4. As in Experiment I, all students learned some abbreviations taught to other students in both conditions, but more observational learning appeared to occur from baseline to CRF criterion rather than from CRF to VRS criterion. The differences between the two conditions (multiple-trial, predictable and single-trial, unpredictable) were mixed: Hank appeared to learn more of the multiple-trial abbreviations whereas Frank learned more of the single-trial abbreviations; Nellie and Alice achieved similar results in both conditions.

Attention Data

Data on the mean percent of trials in which students attended to the attentional cue were collected for all sessions in both conditions. (These data are shown in Table 3.) Although student attention was greater in the multiple-trial, predictable sessions, differences were not large. When compared to Experiment I, however, Hank and Alice appeared to attend less regardless of condition.

DISCUSSION

The results from Experiment II were mixed. Two students appeared to learn faster and to attend more in the multiple-trial, predictable condition, two others were relatively unaffected. In addition, some differential effects were noted in initial sessions. For Hank and Alice, the single-trial, unpredictable condition produced higher percentages of correct responses; however, the reverse was true for Frank and Nellie. When one instructional procedure is clearly more efficient than another for some but not for all students (e.g., the multiple-trial, predictable condition for Frank and Nellie), the more efficient procedure should clearly be used with students whom it appears to benefit.

Since this experiment did not produce consistent substantial differences across students, we hypothesized that the progressive time-delay procedure's effectiveness may have obscured the differences between the two trial sequences. Thus, the purpose of Experiment III was to compare the multiple-trial, predictable sequence with a single-trial, unpredictable sequence when words were taught using a procedure that was not considered errorless. The procedure — model-test — employed a model on the first presentation of each word; thereafter all trials were presented without a model (Fink & Brice-Gray, 1979). Again, data were collected on acquisition, attention, and observational learning.

EXPERIMENT III

METHODS

Participants, Setting, and Materials

Subjects and setting in Experiment III were identical to those of Experiment II. Forty words from the school district's curriculum were selected and taught; each student was taught 10 words. All words were individually hand printed on cards as in Experiment II.

Procedures

General procedures. As in Experiment II, one small-group instructional session was held each school day. Words were taught using the model-test procedure. Two instructional conditions were randomly alternated across days. Students learned five words in the multiple-trial, predictable sequence and five words in the single-trial, unpredictable sequence. Other subjects' target words served as observational learning stimuli. (Students' target words are shown in Table 5.) Each session consisted of 15 trials per group member. Procedures for collecting attention and observational learning data were identical to those of Experiment II. Further, the same group-management contingency and experimental design were employed.

Table 4

Percent of Correct Responses and Percent of Net Gain on Observational Abbreviations for Experiment II

Student Condition	Baseline[a]	CRF Criterion	VRS Criterion	Percent Net Gain from Baseline to CRF Criterion	Percent Net Gain from Baseline to VRS Criterion
Hank					
Mult/Predict[b]	6	50	67	44	61
Singl/Unpred[c]	8	42	50	34	42
Alice					
Mult/Predict[b]	25	83	92	58	67
Singl/Unpred[c]	22	83	92	61	70
Frank					
Mult/Predict[b]	14	58	67	44	53
Singl/Unpred[c]	17	75	92	58	75
Nellie					
Mult/Predict[b]	17	50	67	33	50
Singl/Unpred[c]	14	58	58	44	44

[a]Baseline percentages represent a mean percent of correct responses across three baseline sessions.
[b]Multiple-trial, predictable sequence condition.
[c]Single-trial, unpredictable sequence condition.

Table 5
Target Words by Instructional Condition and Student for Experiment III

Student	Multiple-Trial / Predictable Sequence Words	Single-Trial / Unpredictable Sequence Words
Hank	identify	substitute
	assemble	estimate
	pronounce	initial
	avoid	apply
	moisten	arrange
Alice	examine	enclosure
	screw	smooth
	replace	return
	rotate	compare
	deposit	separate
Frank	scrub	twist
	complete	spread
	squeeze	continue
	operate	prepare
	balance	include
[illegible]	measure	guide
	sign	paste
	reduce	connect
	attach	insert
	sort	record

Multiple-trial, predictable sequence and single-trial, unpredictable sequence conditions. During multiple-trial, predictable sequence sessions, the teacher provided five consecutive trials — one trial on each of the five target words to the student on her left. She then presented the same number of trials to the student seated next to the first student, and so on until all students had received five consecutive trials. This pattern was repeated until all trials had been presented. The single-trial, unpredictable sequence was conducted exactly as in Experiment I. Before each session, the teacher told the group which condition was in effect.

Baseline conditions. Prior to instruction, all 40 words plus 5 known words were presented in 45 trial sessions. Three baseline sessions were conducted prior to a one-week school district vacation, with one session after students returned. Other procedures were identical to those used in Experiment II.

Model-test procedure. Model-test sessions were divided into three blocks of trials so that students received three trials on each of their five words. Model trials were presented during the first model-test session only. During model trials, the teacher held up a word card, said ("Target students name)," ensured that the student was looking at the card, and immediately provided a vocal model of the word. The teacher waited for a 2-5 sec intertrial interval before presenting the next card. Students were not required to imitate the model, and no student responses were scored during model trials. The teacher continued to present model

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trials until students had received one trial on each of their five target words. Immediately following model trials, the teacher presented test trials as follows. The teacher held up the card, said "(Target student's name)," ensured that the student was looking, asked "What word?", waited 3 sec for a response, provided appropriate consequences, and recorded the responses. During test trials student responses were scored as *correct* — the student said the correct word within 3 sec of the question, "What word?"; *incorrect* — the student said any word other than the correct one within 3 sec of "What word?"; or *no response* — the student did not say any word within 3 sec of "What word?" After a correct response the teacher said, "Good", repeated the word, and delivered one token. Incorrect responses resulted in the teacher saying, "No" and saying the correct word. For no responses, the teacher removed the card and waited the intertrial interval. Only test trials were presented during the second and all subsequent sessions. Students exchanged tokens after the sessions. If they had accumulated seven tokens or less, they chose a back-up reinforcer from a different box than if they had 8-15 tokens. The first box contained reinforcers of less value, as determined by a survey of students' preferences. Criterion was identical to that of Experiments I and II.

Reliability

Reliability assessments on student responding and attention were collected as in Experiments I and II. For procedural reliability, the following behaviors were measured: presenting the correct stimulus to the appropriate student, presenting an attentional cue and ensuring a response, asking "What word?", waiting 3 sec for a response, providing correct consequences, and waiting the intertrial interval.

RESULTS

Reliability Estimates

Reliability estimates were calculated using the point-by-point method. Percent agreement on student responding during baseline condition was 100, 97, 96.7, and 96.7 for Hank, Alice, Frank, and Nellie, respectively. Mean percent agreement during the multiple-trial, predictable sequence was 97.6 (range 91.1-100) and 99.2 (range 97.7-100) during the single-trial, unpredictable sequence. For students' responses to the attentional cue, the mean percentage of agreement was 85.8 (range 80-97). Procedural reliability estimates were calculated as in Experiment I. Mean estimates for all teacher behaviors were 98.4 (97-100) in baseline, 99.8 (99.5-100) in the multiple-trial, predictable condition, and 99.6 (98.5-100) in the single-trial, unpredictable condition.

Effectiveness and Efficiency

Due to the end of the school year, the VR3 criterion was not met in either condition. For all students, however, the trend of both conditions was increasing when the study ended (see Figure 3). Hank met the CRF criterion in the multiple-trial, predictable condition only; Frank met the CRF criterion in the single-trial, unpredictable condition only; whereas Alice and Nellie met CRF criterion in both conditions. For Hank and Nellie, the data series for each condition were similar indicating no substantial differences. For both Alice and Frank, initial sessions suggested that the multiple-trial, predictable condition produced a higher percent of correct responses than the single-trial, random condition as evidenced by 0% overlap for all sessions to criterion for Alice and for the first six instructional sessions for Frank (3 each trial sequence). However, while Alice reached criterion first in the multiple-trial, predictable condition, Frank reached criterion in the single-trial, unpredictable condition and did not meet criterion in the multiple-trial, predictable condition by the end of the school year.

A calculation of the trials to criterion revealed no notable differences. Hank and Frank did not reach criterion, and Alice required four sessions with the multiple-trial, predictable condition, compared to six sessions in the single-trial, unpredictable condition; Nellie required five sessions in both conditions.

Percent of errors to criterion presented mixed data. For the multiple-trial, predictable condition, Hank's percent of errors was 13, Alice's 7, Frank's 19, and Nellie's 21. For the single-trial, unpredictable condition, Hank's percent of errors was 5, Alice's 20, Frank's 29, and Nellie's 13.

Observational Learning

The percent of words students learned observationally by condition is presented in Table 6. As in the other experiments, observational learning occurred, much of it taking place prior to the CRF criterion, and no substantial differences were found between conditions.

Attention Data

Students' responses to the teacher's attentional cue were collected on 78% of the multiple-trial, predictable sessions and on 89% of the single-trial random sessions. (These data are presented in Table 3.) As illustrated, Alice attended more on multiple, predictable trials; Frank and Nellie more on single, unpredictable trials, whereas Hank's attending was similar in both conditions. The percentages for Alice and Hank increased from Experiment II in both conditions.

DISCUSSION

The model-test procedure was effective in increasing all students' percent of unprompted correct responses. Specifically, it was effective in establishing criterion-level responding with Alice and Nellie in both trial sequence conditions, with Hank in the multiple-trial, predictable sequence, and with Frank in the single-trial, predictable sequence. For two subjects, Alice and Frank, the initial level of correct responses was higher using the multiple-trial, predictable sequence, but this initial advantage did not maintain, nor was it evident for Hank and Nellie. Error percentages were higher

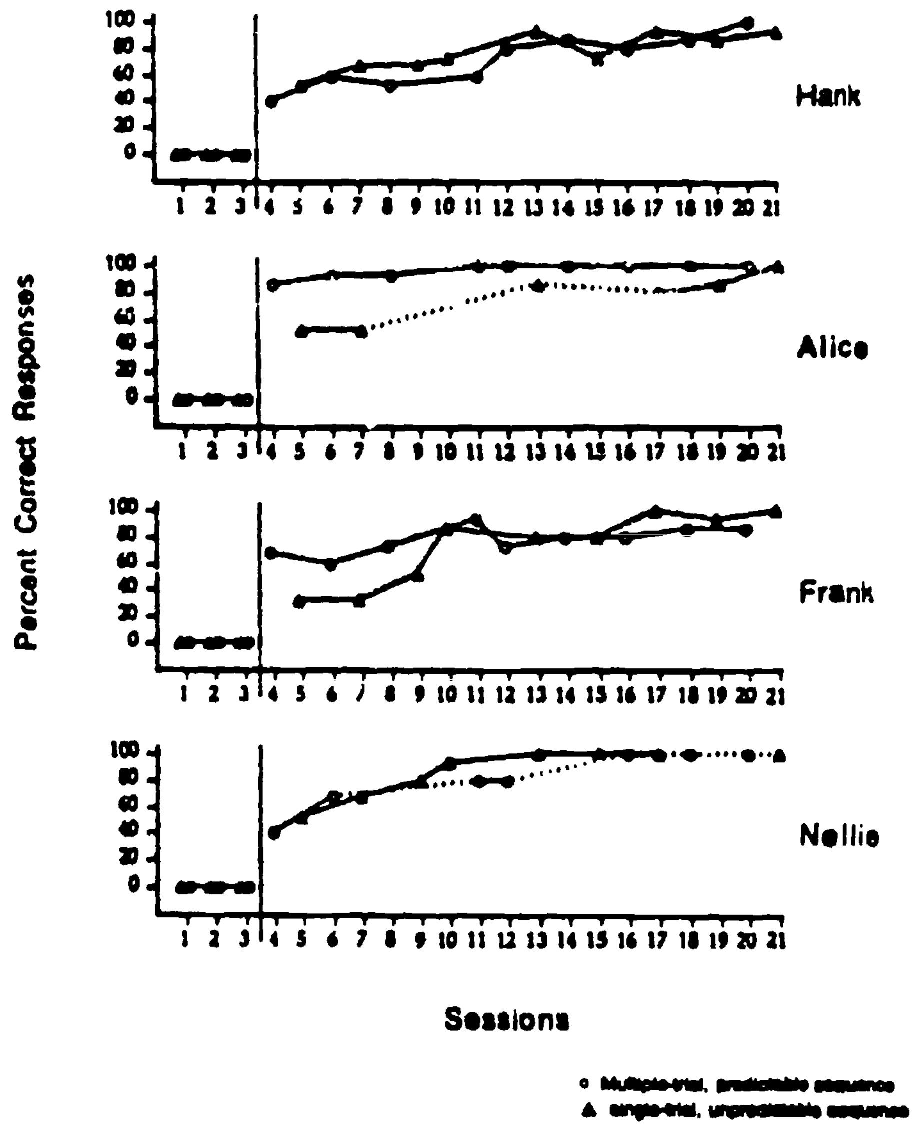

Figure 3. Percent of correct responses for each student when taught with a model-test procedure in multiple-trial, predictable sequence and single-trial, unpredictable sequence for Experiment III. Broken lines between data points indicate student absences.

Table 6
Percent of Correct Responses and Percent of Net Gain on Observational Words for Experiment III

Student Condition	Baseline[a]	CRF Criterion	VRS Criterion	Percent Net Gain from Baseline to CRF Criterion	Percent Net Gain from Baseline to VRS Criterion
Hank					
Mult/Predict[b]	55	93	93	38	38
Singl/Unpred[c]	60	–	87	–	27
Alice					
Mult/Predict[b]	2	53	53	51	51
Singl/Unpred[c]	3	47	47	44	44
Frank					
Mult/Predict[b]	0	--	73	--	73
Singl/Unpred[c]	5	53	60	48	55
Nellie					
Mult/Predict[b]	10	47	73	37	63
Singl/Unpred[c]	10	53	67	43	57

[a]Baseline percentages represent a mean percent of correct responses across three baseline sessions.
[b]Multiple-trial, predictable sequence condition.
[c]Single-trial, unpredictable sequence condition.

for all students with the model-test procedure than in Experiments I and II where the progressive time-delay procedure was used, but it was not differentially affected by the trial presentation sequence.

GENERAL DISCUSSION

The purpose of these experiments was to (a) evaluate the effects of a progressive time-delay procedure in a small-group arrangement; (b) compare the effects of an unpredictable trial sequence with a predictable trial sequence on acquisition, attention, and observational learning; (c) compare the effects of a multiple-trial, predictable sequence with a single-trial, unpredictable sequence on the efficiency measures; and (d) compare the effects of a multiple-trial, predictable sequence with a single-trial, unpredictable sequence when a model-test procedure was used. Several statements can be made based on the findings.

First, in Experiments I and II, the progressive time-delay procedure was used in a small group by an experienced teacher with few procedural errors. This supports previous research indicating that the procedure could be reliably implemented in 1:1 instruction (Ault et al., 1988; Bennett et al., 1986; Godby et al., 1987). Second, the progressive time-delay procedure was effective in teaching word reading and abbreviations to a group of students with learning disabilities. All students reached criterion-level performance with the introduction of the procedure. To date, this procedure has been used more often in one-to-one instructional arrangements in teaching discrete skills to students with moderate and severe handicaps (Ault et al., 1988; Braam & Polling, 1983), but it has also been used successfully with students with mild handicaps (Precious, 1985). The current findings extend those investigations to include effective use of progressive time delay in group instruction with students who were learning disabled and extend previous research showing that constant time delay was effective with this population in 1:1 (Stevens

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& Schuster, 1987) and small groups (Wolery, Alig, Gast, & Boyle-Gast, in press). Efficiency measures from Experiments I and II are similar to progressive time-delay investigations in 1:1 arrangements as the percent of errors was low (5% or less) and stimuli were learned quickly (9 sessions or fewer). Compared to the model-test procedure, substantial differences were found in the error percentages. However, it is unclear to what extent these findings are replicable: (a) with larger groups of students, (b) in group arrangements where substantially different content is being taught, (c) in contexts with more students in the classroom, or (d) in situations where the teacher was less skilled. Clearly, these areas constitute topics for future research.

Third, no consistent effects of the trial presentation methods were found across investigations. No substantial difference between the two conditions occurred for all four subjects in Experiment I. This may be because the students were experienced learners and because the progressive time-delay procedure was a powerful strategy producing rapid acquisition with minimal errors. In Experiment II, when differences between the two trial presentation sequences were increased, some differential effects occurred, but the results were mixed. In both conditions, Hank and Alice required a similar number of sessions, but for Frank and Nellie, the multiple-trial, predictable sequence resulted in fewer sessions to criterion and a lower percentage of errors to criterion than did the single-trial, unpredictable condition. Although some differences were noted, it is likely that the progressive time-delay procedure, because of its frequent prompts and gradual fading of prompts in time, may have overridden the effects of the trial presentation sequence. To investigate this possibility, the model-test procedure that involved fewer prompts and removed those prompts more abruptly was used in Experiment III. Due to the end of the school year, criterion was not reached in all trial sequence conditions. However, the results indicated that the multiple-trial, predictable sequence produced higher levels of correct responding for two students in the initial sessions. Thus, for experienced learners such as those included in this study, it appears that manner of trial presentation does not affect learning. Teachers should feel free, therefore, to select a trial presentation sequence that fits their needs.

The failure to find consistent differences across experiments suggests that factors such as the trial sequence may be important only for some students or during some phases of instruction. Clearly, the emerging data on task variation (Dunlap, 1984; Neef et al., 1980) were not replicated in these experiments. Previous research on task variation, however, used different types of tasks rather than the same task presented in different ways. Future research should address the combined effects of varied tasks and varied trial presentation formats.

Fourth, it is interesting to note that, as measured by the observers, attention was relatively low, yet acquisition of target and observational items occurred. It may be that attention, as measured in these experiments (i.e., looking at the stimulus card when the instructor gave the group attentional cue), was not a sensitive index of students' attention to instructional stimuli. Since attending data were taken only at the time the instructor gave the attentional cue and only when the observer glanced at the student, some attending behaviors may have occurred but were not measured.

Fifth, each student involved in the group learned additional stimuli by observing others in the group. The majority of observational words were learned from the first session of instruction until the individual CRF criterion was met. Some additional words were learned after the CRF criterion, but not to the same extent. This indicates that during acquisition of their target words students simultaneously learned other students' words. After students had learned their own words, however, and were given overlearning trials to fulfill the group criterion, less observational learning occurred. It may be that during acquisition of their target words they were more actively attending to all instructional stimuli. This assumption is supported, in part, by increased variability and decelerating trends in the attention data over the course of each experiment.

In addition, a student who was seated near but did not participate in the group activity also learned a substantial number of the target stimuli. This student was noted watching the sessions during Experiment I, and it was decided to measure the effects of that exposure. Thus, he was pre- and post-tested on all the subjects' stimuli in Experiments II and III. No contingencies for responding or attending were in effect. In Experiment II, he acquired 91% of the abbreviations and in Experiment III 43% of the words taught to the subjects. It is not clear what controlled his learning other than the opportunity to observe the instruction. Although proximity appeared to be necessary, it is unlikely that it was sufficient to ensure such learning.

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FOOTNOTES

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Appendix F

Gast, D. L., Wolery, M., Morris, L. L., Doyle, P. M., & Meyer, S. (1990). Teaching sight word reading in a group instructional arrangement using constant time delay. Exceptionality, 1, 81-96.

Exceptionality (1990) 1:81–96

EXCEPTIONALITY

Teaching Sight Word Reading in a Group Instructional Arrangement Using Constant Time Delay

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Abstract. In this investigation we examined the effectiveness of constant time delay (CTD) in a small group instructional arrangement. Five primary-aged students in a self-contained classroom for students with moderate delays were taught to read environmental sight words. In addition, we assessed observational learning (students learning other group members' words) across each instructional condition. The definitions of the words taught were inserted in the descriptive verbal praise statement after correct responses. We assessed students on their acquisition of the definitions of their target and observational learning words. We used a multiple probe design across word sets to assess the effectiveness of the CTD procedure in the small group instructional arrangement. The results indicated that (a) CTD was effective in teaching sight words to four students, (b) students acquired some information targeted for other students, and (c) students acquired a minimal amount of information presented in the praise statements for their own and other group members' target behaviors.

Researchers have found constant time delay (CTD) to be an effective and efficient instructional strategy for teaching students with handicaps in one-to-one instructional arrangements (Handen & Zane, 1987). The procedure is quite straightforward. It begins by presenting several trials in which the discriminative stimulus (e.g., printed word) and controlling prompt (e.g., spoken word) are paired. After one or two zero second delay trials on each target stimulus, the controlling prompt is delayed a specified number of seconds (e.g., 3 s). All subsequent trials are presented at this delay until criterion is reached. Typically, within the first two sessions, subjects begin to respond prior to the delivery of the prompt showing a transfer of stimulus control from the prompt to the target stimulus.

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Table 1. Students, target word pairs, order of instruction, and target stimuli

Order of instruction	Students				
	Colin	Brent	Andrea	Tommy	Delbert
Set 1	closed county	doctor dentist	enter exit	nurse name	push pull
Set 2	stairs state	ambulance entrance	cold city	police poison	telephone emergency
Set 3	operator hospital	no swimming elevator	warning caution	ladies danger	no trespassing no barefeet
Set 4	fire taxi	escalator no admittance	open stop	employees only emergency exit	fire escape fire exit

making eye contact with the word card within 4 s of the group attending cue. This was followed by the teacher ensuring an individual attending response from the targeted student and presenting the task direction "(Student's name), look. What word?"

Probe procedures. Individual probe sessions consisted of 40 trials: one trial on each of the 8 target words and one trial on each of the 32 observational words. The teacher conducted a minimum of three probe sessions in each probe condition, or until the data stabilized. Probe conditions occurred prior to instruction on the first word pair and after all students met criterion on their word pairs. During probe conditions, the teacher presented the word card, said "(Student's name), look," secured an attending response, and provided the task direction, "What word?" The student had 4 s in which to respond. If a student made a correct response within the 4-s response interval, the teacher provided verbal praise and the choice of an edible or toy on a continuous reinforcement schedule (CRF). No response and all incorrect responses were ignored, followed by the teacher waiting the 3–5 s intertrial interval. To maintain student attention, the teacher delivered verbal praise and an edible on a VR3 schedule for making eye contact with the word card and sitting appropriately. During the last two sessions of Probe IV and Probe V, she reinforced correct responses on a VR3 rather than a CRF schedule, and reinforced attending behaviors on a VR10 rather than a VR3 schedule. This was done to maintain subject responses following the final instructional condition.

Constant time delay. The teacher conducted instructional sessions in a small group arrangement using a 0–4-s CTD procedure. Each session consisted of 30 trials: 6 trials per subject, three trials per word from each pair. We divided each session into six blocks of five trials with students receiving one trial in each block. Words were randomly intermixed across the six blocks. During session 1, we implemented a 0-s delay in which the teacher provided the group and individual attending cues, presented the task direction, and immediately modeled the correct word name. In all subsequent sessions, we inserted a a 4-s delay interval between the presentation of the task direction and the teacher's delivery of the model. Both correct responses before the prompt (anticipations) and correct responses after the prompt (correct waits) resulted in the teacher providing descriptive verbal praise and an edible or toy. The descriptive verbal praise statement included the teacher saying, "Good," repeating the word name, and providing an abbreviated definition of the word (e.g., "Exit means to go out"). Only anticipations counted toward criterion. Errors occurring before the prompt (nonwait errors) and after the prompt (wait errors) resulted in the teacher saying, "No," waiting the 3–5-s intertrial interval, and presenting the next trial. A no response resulted in the teacher waiting the intertrial time, and presenting the next trial.

In order to move to a probe condition, a group criterion had to be met. That is, all students had to perform at 100% anticipations on their two target words, when reinforced on a CRF schedule for one se... n, followed by two consecutive sessions at 100% anticipations, when reinforced on a VR3 schedule. If a student attained criterion on his targeted words before other members of the group met criterion on their words, he or she remained in the group and received trials as usual.

Observational Learning

We defined observational learning as a student learning the target words of other students. For each student and each instructional condition, there was one word pair (two words) receiving direct instruction, and four word pairs (eight words) that students could learn through observation. We collected observational learning data on the first day a student met criterion on his or her target pairs (to criterion). Each assessment session consisted of eight trials, one trial for each observational word, conducted by the teacher using the probe trial procedure. The purpose of this session was to determine whether observational learning occurred simultaneously with the acquisition of target words. When all students in the group met criterion (through criterion), observational learning was again measured in each probe session.

Incidental Information

During each probe condition, one of the investigators individually assessed the students on their acquisition of sight word definitions. The teacher provided definitions as part of the descriptive praise statement during CTD instruction. During Probe I, we assessed all 40 word definitions. Beginning with Probe II, we assessed only those definitions of words just presented (e.g., Pair 1) and those to be presented in the next instructional condition (Pair 2). The investigator tested students on definitions for their two target words, as well as those words taught to the other members of the group. A total of 20 word definitions were tested each session; one trial per word. A trial began with the investigator securing the student's attention and providing the task direction, "(Student's name), look, what does (word) mean?" The student had 4 s to respond. The investigator reinforced correct responses on a CRF schedule with verbal praise and an edible, but ignored incorrect and no responses.

Experimental Design

We used a multiple probe design (Tawney & Gast, 1984) across four word pairs, with reinforced probe conditions, to evaluate the effectiveness of the CTD procedure. Differential reinforcement of correct and incorrect responses on probe trials increased the probability that students would respond correctly during probe conditions and decreased the probability that probe data were a deflated representation of students' abilities. Experimental control was demonstrated when probe performance remained stable until the introduction of the CTD procedure, upon which there was an abrupt change in level and trend that stabilized at criterion. The sequence of experimental conditions was as follows: probe all word pairs in one-to-one sessions; teach one word pair to each student in the group until all students meet criteria; probe all word pairs; and repeat this sequence until all word pairs have been taught. The fourth word pair served as a control for each student. An experimental analysis of students' acquisition of observational and incidental learning was also possible using this design.

Agreement

One of the investigators collected interobserver agreement data on student responding at least once every condition, or every five days. We used a point by point method to calculate agreement estimates in which the number of agreements is divided by the number of agreements and disagreements multiplied by 100. We collected procedural agreement data (Billingsley, White, & Munson, 1980) simultaneously with interobserver agreement data. Data were collected on the teacher's compliance with written procedures. Instructor behaviors measured for all experimental conditions included: presenting the correct word card; securing the group and individual attending response; presenting the task direction; waiting the appropriate response interval; delivering the appropriate consequence based on a student's response; and waiting the correct intertrial interval. In addition, we collected data on whether the teacher waited the appropriate delay interval before delivering the model and complied with group-oriented contingency procedures during CTD instruction. We calculated agreement estimates on each of these teacher behaviors using the formula, number of observed teacher behaviors divided by the number of planned teacher behaviors multiplied by 100.

Results

Agreement Data

The mean percentages of agreements on student responding for Colin, Brent, Tommy, Delbert, and Andrea in probe conditions were 98.3% (range 95–100%), 99.1% (range 95–100%), 98.9% (range 95–100%), 99.6% (range 98–

Table 2. Mean percentages of correct responding during probe conditions using CTD procedure

Student	Target stimuli	Probe I, %	Probe II, %	Probe III, %	Probe IV, %	Probe V, %
Colin	Pair 1	0	100	100	100	
	Pair 2	0	0	100	100	
	Pair 3	0	0	0	92.9	
	Pair 4	0	0	0	0	
Brent	Pair 1	0	100	100	71.4	100
	Pair 2	0	0	100	50	100
	Pair 3	0	0	0	92.9	[illegible]
	Pair 4	0	0	0	0	0
Andrea	Pair 1	0	100	100	100	100
	Pair 2	0	0	100	35.7	100
	Pair 3	0	0	0	92.9	100
	Pair 4	0	0	0	0	0
Tommy	Pair 1	0	100	100	85.7	100
	Pair 2	0	0	100	78.6	100
	Pair 3	0	0	0	92.9	100
	Pair 4	0	0	0	0	0

100%), and 99.6% (range 98–100%), respectively. The mean percentages of agreement for student responding during CTD conditions were 98.5% (range 83–100%) for Colin, 98.3% (range 83–100%) for Delbert, and 100% for Brent, Tommy, and Andrea. Procedural agreement estimates, that is, mean percentage of compliance, during probe conditions was 99% (range 98–100%) for Colin, 100% for Brent, 98.4% (range 85–100%) for Andrea, 99.6% (range 95–100%) for Tommy, and 99.3% (range 85–100%) for Delbert. During CTD instructional sessions, the range of agreements for the group across all behaviors was 93–100% compliance. All teacher behaviors were at 100% agreement with the exception of the teacher waiting the specified delay interval (mean 98.5%; range 93–100%), providing the correct consequence (mean 99.4%; range 97–100%), and presenting the group attending cue (mean 99.7%; range 96–100%).

Effectiveness of Constant Time Delay

The mean percentages of correct responding (anticipations and waits) for the group across word pairs are shown in Fig. 1. The mean percentages of correct responding in the probe conditions for individual students are shown in Table 2. As shown in Fig. 1 and Table 2, all students responded at 0% across untrained target word pairs during probe conditions. During CTD instruction on the first word pairs from Set 1, responding increased to criterion level without any procedural modifications for Colin. However, because Brent, Andrea, Tommy, and Delbert consistently waited for the controlling prompt (teacher model), we implemented differential reinforcement with these students. Procedurally, this modification meant that anticipations received descriptive verbal praise and an

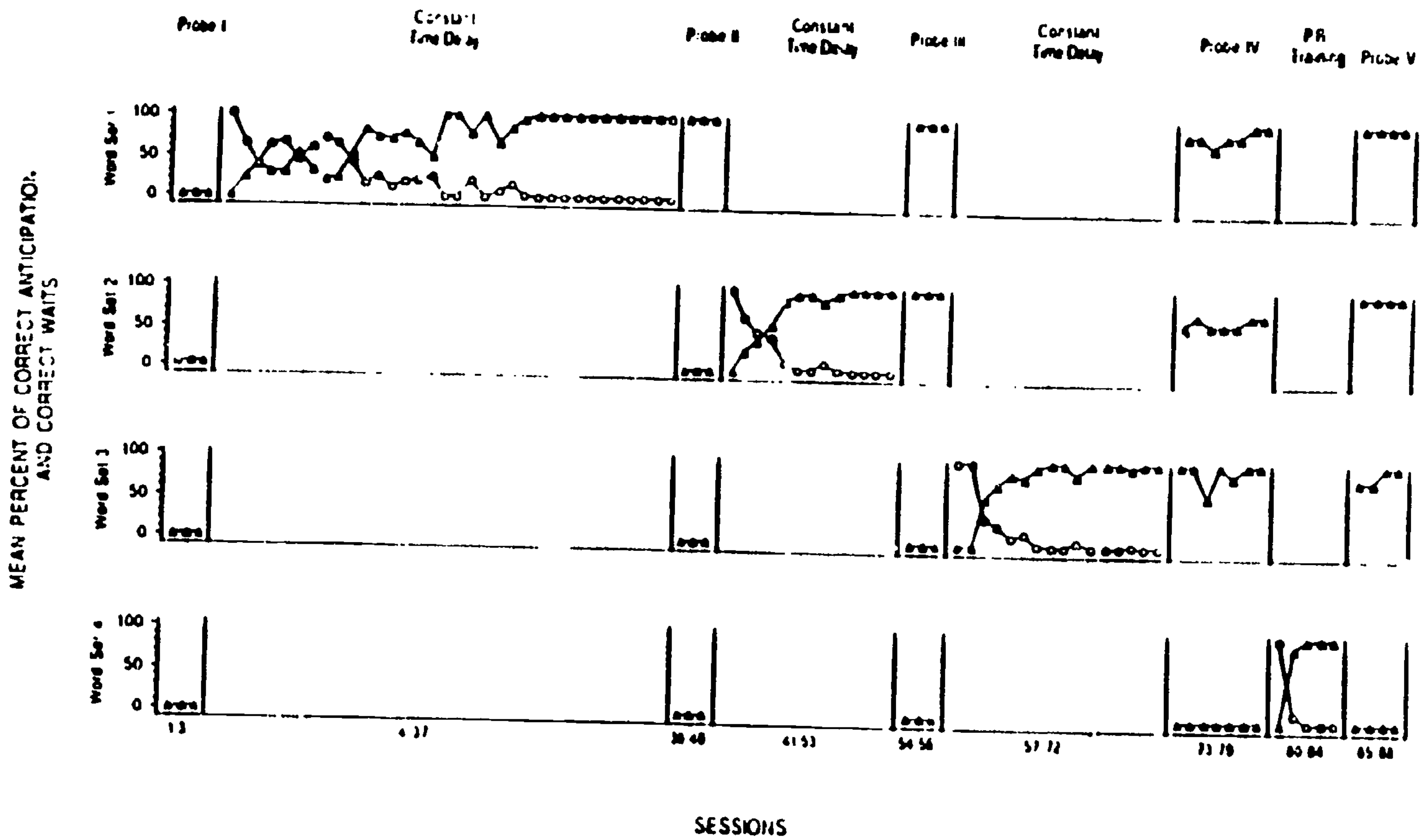

Fig. 1. The mean percentages of prompted and unprompted correct responses using a CTD procedure for Colin, Brent, Andrea, and Tommy. The closed triangles indicate correct anticipations, open circles correct waits.

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edible or toy, whereas correct waits received only the descriptive verbal praise. This modification was effective in producing criterion level responding for Brent, Andrea, and Tommy. However, it was ineffective for Delbert. The effectiveness of the CTD procedure was replicated for Colin, Brent, Andrea, and Tommy without any procedural modifications across the next two pairs of words from Sets 2 and 3. In Probe IV, Brent, Andrea, and Tommy did not maintain criterion level responding on all of their target words. Consequently, the teacher implemented a retraining instructional condition with these students using the CTD procedure. After retraining, we conducted a final probe, and each of the students maintained criterion level responding on all target words. Word pairs from Set 4 were not taught to any student due to time restrictions and served as untreated control words.

In addition to differential reinforcement, we instructed the teacher to implement various procedural modifications throughout the investigation for Delbert. These modifications included: (a) the addition of a specific attentional response in which he was required to name the letters of the word in sequence after the teacher's model prior to giving him the opportunity to read the word; (b) thinning the schedule of reinforcement for group attending; (c) teaching one word in isolation; and (d) conducting supplemental one-to-one instructional sessions while he continued to participate in group instruction. However, these modifications were not effective in establishing a conditional discrimination with this student. The last modification attempted before the end of the school year was teaching Delbert in a one-to-one arrangement and reassigning words to the pair. One word from the initial pair (pull) was taught with one word he had learned through observation (exit) during the first CTD condition. The original 4-s CTD procedure was used. This modification was effective in teaching Delbert to respond differentially to the words "pull" and "exit."

Efficiency Data

The number of trials, number of errors, percentage of errors, and number of minutes of direct instructional time to criterion for Colin, Brent, Andrea, and Tommy are presented in Table 3. These efficiency data *to criterion* are based on the first instructional session that a student met the 100% CRF criterion on his or her target word pair. As shown in Table 3, the total number of trials, errors, percentage of errors, and direct instructional time decreased with each subsequent CTD instructional condition. The mean number of trials to criterion was 82.5 (r = 30–108) in the first CTD condition, 39 (r = 30–60) in the second, and 27 (r = 18–48) in the third and final instructional condition. The number of errors and percentages of errors to criterion showed similar decreases. In the first CTD condition, the mean number of errors was 7.75 (r = 0–13) and the mean percentage was 9.4% (r = 0–13.5%). The second application of CTD in the small group resulted in a mean number of errors of 1.74 (r = 1–2) and a decrease in the percentage of errors to 4.5% (r = 3.3–6.6%). The mean number and percentage of errors decreased to 0.5 (r = 0–2) and 1.9% (r = 0–8.3%), respectively, in the third CTD instructional condition. Finally the total amount of time spent by the teacher and students engaged in group instruction until

Table 3. Efficiency measures to criterion across three instructional conditions

Word pair Student	Number of trials	Number of errors	Percent of errors	Instructional time*
Word Pair 1				
Colin	30	0	0	1 h:32 min
Brent	96	13	13.5	4 h:45 min
Andrea	108	13	12	5 h:42 min
Tommy	96	5	5.2	4 h:51 min
Totals	330	31	9.4	5 h:42 min
Word Pair 2				
Colin	30	2	6.6	1 h:26 min
Brent	36	1	3.3	1 h:47 min
Andrea	30	2	6.6	1 h:32 min
Tommy	60	2	3.3	3 h:08 min
Totals	156	7	4.5	3 h:08 min
Word Pair 3				
Colin	18	0	0	1 h:15 min
Brent	18	0	0	1 h:07 min
Andrea	24	2	8.3	1 h:32 min
Tommy	48	0	0	2 h:55 min
Totals	108	2	1.9	2 h:55 min

* The total amount of instructional time to criterion is equal to the number of hours and minutes it took the slowest student in the group to reach *to criterion* level responding.

criterion, decreased by 2 h 34 min from the first to the second CTD instructional conditions, and by 2 h 47 min from the initial CTD condition to the final CTD instructional condition.

Observational Learning

The percentages of correct responding for observational words for Colin, Brent, Andrea, and Tommy are shown in Table 4. Prior to the first instructional condition, Colin was the only student who was able to identify any of the words targeted for other group members. He correctly read one word from a pair assigned to Andrea in the first instructional condition (12.5%) and one word from another pair assigned to Andrea in the fourth instructional condition (12.5%). All correct responding to the remaining observational words was at zero percent across word pairs and students prior to instruction. After reaching criterion level responding on their pairs of target words, we assessed students for acquisition of observational words (Called: "to criterion"). We also assessed them in the probe condition after the group met criterion on each set. In all cases, students learned some of their group members' words, and much of this learning occurred before they met criterion on their target words rather than during overlearning trials. We also measured maintenance of observa-

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Table 4. The percentages of correct observational responding

Student	Word pair	Probe I, %	To criterion, %	Probe II, %	To criterion, %	Probe III, %	To criterion, %	Probe IV, %
Colin	1	0	12.5	91.7		87.5		75
	2	12.5		12.5	100	83.3		85.7
	3	0		0		0	100	69.6
	4	12.5		8.3		12.5		12.5
Brent	1	0	70	66.7		79.2		33.9
	2	0		0	50	45.8		21.4
	3	0		0		0	57	60.7
	4	0		0		0		0
Andrea	1	0	37.5	66.7		41.7		33.9
	2	0		0	25	33.3		16.1
	3	0		0		0	28.6	25
	4	0		0		0		0
Tommy	1	0	37.5	54.2		37.5		28.6
	2	0		0	25	16.7		16.1
	3	0		0		0	28.6	33.9
	4	0		0		0		0
Totals across students	1	0	34.4	69.8		61.5		42.9
	2	3.1		4.2	50	44.8		34.8
	3	0		0		0	53.6	47.3
	4	3.1		2.1		3.1		3.1

tional learning. Students tended to maintain some, but not all, of their observational learning.

Incidental Information

During instruction, the teacher included the definition of the words (incidental information) in the descriptive praise statement following correct responses. The percentages of correct responding on target and observational words when measured in the probe conditions are shown in Table 5. All students learned some of the incidental information, definitions, from the descriptive praise statements. Further, learning occurred in a relatively equal manner across target words and words taught to other group members. Thus, students were able to learn definitions to about a third of the words taught simply from hearing the teacher say the definition in the praise statement. Interestingly, there were substantial differences in the amount that each student learned; for example, Brent learned considerably more than Tommy. The controlling variable responsible for this difference is not known.

Discussion

The purposes of this study were to (a) evaluate the effectiveness of a CTD procedure in a small group instructional arrangement, (b) report the efficiency

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Table 5. The percentages of correct incidental responding for target and observational words

Student	Word pair	Probe I Target, %	Probe I Observ., %	Probe II Target, %	Probe II Observ., %	Probe III Target, %	Probe III Observ., %	Probe IV Target, %	Probe IV Observ., %
Colin	1	0	0	0	37.5			0	4.2
	2	0	0	0	0	66.7	25	3.3	12.5
	3	0	0			0	0	0	33.3
	Pretest		0	0			Posttest	22.2	31.9
Brent	1	50	12.5	100	95.8			50	45.8
	2	0	12.5	16.7	4.2	100	62.5	0	62.5
	3	50	8.3			0	0	50	54.2
	Pretest	33.3	11.1				Posttest	83.3	70.8
Andrea	1	16.7	8.3	50	41.7			0	37.5
	2	33.3	16.7	50	29.2	50	45.8	16.7	33.3
	3	0	12.5			0	12.5	0	20.8
	Pretest		16.7	12.5			Posttest	33.3	36.1
Tommy	1	0	0	16.7	16.7			0	8.3
	2	0	0	0	12.5	16.7	20.8	0	8.3
	3	0	0			0	0	0	0
	Pretest		0	0			Posttest	11.1	12.5
Totals across students	1	16.7	5.2	41.7	47.9			12.5	23.9
	2	8.3	7.3	16.7	11.5	58.4	38.5	5.0	26.7
	3	12.5	5.2			0	3.1	12.5	27.1
	Pretest	12.5	5.9				Posttest	37.5	37.8

data of this procedure, (c) identify the acquisition of words through observational learning, and (d) investigate the acquisition of incidental information presented in the descriptive praise statements. Based on the findings of this investigation, we can draw four conclusions.

First, teachers can successfully implement the CTD procedure in a small group arrangement in order to teach new skills. This procedure, although effective in one-to-one instructional arrangements (Ault et al., 1988), has not been used extensively with small groups (Alig, Wolery, & Gast, in press). Data presented in Fig. 1 and Table 2 indicate that four students with moderate handicaps reached criterion level performance across three sets of word pairs. The CTD procedure was initially ineffective in establishing criterion level performance with Delbert; however, he eventually established a conditional discrimination after various procedural modifications were implemented in a one-to-one instructional arrangement. Although there were a series of manipulations that occurred prior to successful criterion level performance, it appears that the difficulty of the initial discrimination between words in Pair 1 (push/pull) may have contributed to Delbert's inability to reach criterion level. The final manipulation of re-pairing the stimuli resulted in his reaching criterion level responding. Although we found that a classroom teacher could implement this procedure both effectively and reliably, additional research is needed to extend its use with other populations and tasks. In addition, investigations should attempt to compare this procedure to other instructional strategies shown to be effective in one-to-one instructional arrangements (e.g., system of least prompts and most to least prompting).

Second, CTD became more efficient over time. Although each of the students had a history of learning with this procedure, the teacher had not used CTD with these students in a small group arrangement. This may have contributed to the greater number of trials, errors, and direct instructional time to criterion in the first instructional condition. This initial application of CTD resulted in twice the total number of trials to criterion as the second CTD condition and 3 times the number of trials as the third condition. Similar results are shown for the number of errors. That is, in the first CTD condition, students made 4 times the number of errors as in the second instructional condition and 15 times the number of errors as in the third. Direct instructional time also decreased over time as the students learned to learn with CTD in the small group arrangement.

Third, all students acquired some target information through observation, although the percentages of correct responding were not maintained in subsequent probe conditions. This is particularly evident based on a comparison of students' performances in the final probe condition with their *to criterion* performances. The exception was the percentage of net gain in correct observational responding on words from the first instructional set. Each of the students in the group responded at higher levels in Probe II than when *to criterion*. This increase may be attributed to the number of overlearning trials Colin, Brent, Andrea, and Tommy received as they waited for Delbert to reach criterion. It might be expected that the increase in the number of exposures to information of other students would result in greater percentages of observational learning. However, the percentages of correct responding in Probe II for Set I words did not maintain in subsequent probe conditions. The percentages of correct responding may have maintained at the *to criterion* levels if we had specifically programmed for maintenance (e.g., review trials on previously learned target behaviors, Doyle, Gast, Wolery, Ault, & Farmer, 1989). We need additional research on how to (a) measure observational learning in small group instruction, (b) arrange small group instruction in order to facilitate observational learning, and (c) maintain observational learning once the student demonstrates acquisition.

Finally, each student acquired incidental information inserted in the descriptive praise statements. Minimal differences existed in the amount of incidental information learned for target and observational words. The low percentages of correct responding to the incidental information may relate to the difficulty of the target task (i.e., students did not know the referents or word meaning for the sight words). This information, the definition, was presented in the descriptive praise statements as the incidental learning task. In summary, future investigations should focus on the use of various instructional strategies in small group arrangements. In addition, research should investigate strategies for facilitating the acquisition of target and nontarget information through observational learning.

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Appendix G

Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (in press). Acquisition of incidental information during small group isntruction. Education and Treatment of Children.

Acquisition of Incidental Information During Small Group Instruction[1]

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Running Head: Small Group Instruction

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Abstract

This investigation studied the acquisition of incidental information (spelling) when subjects were taught to read sight words. Four primary-aged students with mild mental retardation placed in a classroom for students with multiple handicaps, served as subjects. Instruction occurred in a small group arrangement using a constant time delay procedure. The teacher presented the spelling of the target word either prior to the student reading the word, or as part of the consequent event, following a student's response. A multiple probe design across word sets was used to assess experimental control of both the acquisition of incidental information and the effectiveness of the constant time delay procedure. The results indicated that: (a) each student acquired some of the non-targeted spelling information and b) constant time delay was effective in teaching all words to each of the four students. These findings are discussed in terms of designing effective and efficient small group instruction for students with disabilities.

Acquisition of Incidental Information During Small Group Instruction

Small group instructional arrangements have been an effective and viable alternative to one-to-one instruction in classrooms serving students with a variety of disabilities (Alberto, Jobes, Sizemore, & Doran, 1980; Browder, Hines, McCarthy, & Fees, 1984; Fink & Sandall, 1980; Oliver & Scott, 1981). An often cited advantage of group instruction is that it allows for observational learning (Browder, Schoen, & Lentz, 1987; Oliver & Scott, 1981; Orelove, 1982; Westling, Ferrell, & Swenson, 1982). Bandura (1986) defined observational learning as the ability to acquire new skills through the observation of the behavior of a model. In the context of group instruction, observational learning may occur by a student imitating either the teacher's, or another student's model of (a) the correct target response or (b) incidental information presented by the teacher or student that is related to but not targeted for direct instruction.

The use of a small group instructional arrangement does not preclude the use of systematic and empirically verified instructional methods (Brown, Holvoet, Guess, & Mulligan, 1980). The constant time delay procedure entails inserting a fixed amount of time (e.g., 4 seconds) between the presentation of the discriminative stimulus (task direction or material) and a controlling prompt (e.g., teacher's model) after a series of simultaneous or 0-sec delay trials. This strategy effectively transfers stimulus control from the controlling prompt to the novel stimulus (Demchak, 1990; Wolery & Gast, 1984).

Recent investigations have shown that the constant time delay procedure can be both effective and efficient in small group instructional arrangements. Schoen and Sivil (1989) arranged students into dyads and compared the system of least prompts and constant time delay procedures in teaching self-help skills to preschoolers with developmental delays. Although both were effective in establishing the new skills, the time delay procedure was found to be slightly superior in terms of the number of sessions to criterion. Each of these procedures resulted in students learning the other dyad member's target information through observation alone. Wolery, Cybriwsky, Gast, and Boyle-Gast (in press) used a constant time delay procedure with either specific or general attending cues to teach facts about local service and government agencies and over-the-counter medications to a group of four secondary-aged students with learning disabilities. In this investigation, the constant time delay and efficient in teaching these facts. The students acquired not only their own target information, but also other student's target behaviors and related but non-targeted incidental information. In addition, the results showed that requiring a specific attentional response facilitated both types of observational learning.

Another investigation which used a constant time delay procedure in a small group arrangement (Cybriwsky, Wolery, & Gast, in press) taught beginning sight word reading to preschoolers with developmental delays. The investigation required the teacher to spell each of the target sight words and for the student to repeat the correct spelling as part of a specific attending cue during instruction. The results showed that the constant time delay procedure was effective in teaching the target words, that some observational learning of other students' target words did occur, and that the percent of correct spelling for words taught with the specific attending response was greater than for words taught requiring a general attending response e.g., orienting toward the target stimulus).

Doyle, Gast, Wolery, Ault and Farmer (1990) in replicating the Wolery et al. (in press) investigation with four students with moderate mental retardation, presented non-targeted, related information in the descriptive praise statements following correct responding. The results showed that the students, when taught with a constant time delay procedure, learned the target information with very few errors, learned other students' target information, and learned the incidental information when presented in the consequent event following correct responding. It appears from the results of these investigations that although there were no structured environmental arrangements made between students to facilitate the learning of the other students' target behaviors or of the incidental information (e.g., structured peer interactions or interdependent contingencies), observational learning did occur through the systematic presentation of a model of the correct response alone by other students and/or the teacher.

The primary purpose of this investigation was to assess the extent to which a group of primary aged students with mild mental retardation could acquire incidental information through observational learning. The target task was sight word reading and the incidental information task was the spelling of target words. Observational learning was defined as the students' ability to spell target words after observing a teacher model. In this investigation, no direct instructions or consequences were programmed for spelling of the target words. Correct spelling, in addition to the delivery of a corresponding manual sign, has been used to facilitate sight word reading (Sensing, Mazelka & Topf, 1989). In the present investigation, however, the question raised was whether students would learn to spell words through observation of a teacher's model when presented either before (antecedent condition) or after (consequence condition) the student was required to read the word aloud. In addition, this investigation was an attempt to replicate the effectiveness of the constant time delay procedure in a small group arrangement while teaching sight word reading. It did not, however, attempt to compare constant time delay to other sight word reading procedures or programs (Brown, 1984; Freeman & McLaughlin, 1984; O'Shea, Sindelar & O'Shea, 1987; Cohen, Torgesen & Torgesen, 1988; Torgesen, Waters, Cohen & Torgesen, 1988).

Methods

Subjects and Setting

Four males, ranging in age from 7 years 10 months to 8 years 8 months, who were enrolled in a public school classroom for students with multiple handicaps and who functioned in the mild mental retardation range participated in the study. Parental permission was secured for all students prior to beginning the study. All students exhibited the following entry skills: (a) intact auditory and visual systems (students consistently responded to auditory and visual stimuli with corrective appliances when necessary); (b) appropriate attending behaviors in a group (students sat and made eye contact with the teacher and materials for 20 minutes within the small group arrangement); (c) previous history with the constant time delay procedure (students waited up to 4 sec for a prompt and orally imitated an expressive teacher model); and (d) minimal reading skills (all students could read a variety of consonant-vowel-consonant words and basic survival words such as EXIT, STOP, MEN). A more detailed description of the students is presented in Table 1.

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Insert Table 1 about here

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Instructional sessions were conducted by the special education classroom teacher in the students' (6.4 m x 8.9 m) classroom. All students were seated together at a (2.0 m x 1.0 m) table located in the back of the classroom. The instructor and students were arranged so that all word cards were visible and all student responses were audible to each member in the group. Students not involved in the study participated in regular classroom activities with the instructional assistant.

Materials

A total of 12 words representing objects found in the students' environment were selected as target stimuli by the teacher based on students' Individualized Education Program objecvtives. The classroom staff were given a list of words to ensure that target words were not taught during regular classroom activities. Each word was printed in black lower case letters on the front of 10 cm x 15 cm white cards. On the back of each card a written cue informed the teacher (a) if she was to spell the word (i.e., present the incidental information) and (b) when the incidental information was to be presented in the trial sequence (before or after the students' target response). For each target word there was a colored picture which was used to test the sight word referent. These pictures were presented on 17 cm x 22 cm cards. Target words and the order of instruction are presented in Table 2. The tangible reinforcers selected as prizes for the students were age-appropriate toys and games (e.g., magic tricks, Micro Machines, hand-held puzzles) and a wide variety of edibles (candy bars, M & M's, Skittles). These items were given to students after each session, non-contingent of performance, in keeping with the teacher's classroom practice.

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Insert Table 2 about here

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Experimental Design and Assessment Conditions

Experimental design. A multiple probe design across word sets and replicated across students (Tawney & Gast, 1984) was used to evaluate the acquisition of incidental information (spelling) through observation, and the effectiveness of the constant time delay procedure. Following individual pretests to assess the students' ability to read and spell each of the 12 targeted words, students were assessed on their reading of all words and spelling of Word Set 1 in individual probe sessions. Differential reinforcement of correct and incorrect reading responses during probe sessions was used to increase the probability that students would respond under the probe condition, which permitted a more stringent test of the effectiveness of the constant time delay procedure alone. After the first probe condition, students were taught the same three words from Word Set 1 in a small group instructional arrangement. Prior to daily instructional sessions, one individual probe trial was conducted on reading the three taregt words with each of the students. When all students reached criterion level responding, a probe condition was conducted which assessed sight word reading of all 12 target words and spelling of the words just learned (e.g., Word Set

1) and the words to be learned in the next instructional condition (e.g., Word Set 2). This sequence was repeated until all four word sets had been taught.

Incidental and generalization pretest and posttests conditions. This investigation included a number of measures used to select the target words and assess student acquisition of incidental and generalization information prior to Probe 1, following each instructional condition, and after the final probe. Descriptions of the tests, the times of assessment, and criteria for selecting words as target words are shown in Table 3. Procedures followed were identical to those used during probe conditions.

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Insert Table 3 about here

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Probe conditions. Prior to instruction on each set of words, students were assessed in three individual probe sessions on their ability to read the 12 target sight words. Before each test session students selected a prize which was delivered immediately after the session and non-contingent on performance. Each student was tested individually and received a total of 26 trials per session (two trials on each of the 12 target words and two trials on known words). The two known words were randomly intermixed with unknown words to ensure that the students would respond and receive reinforcement (descriptive praise) for correct responding during the probe sessions. All probe trials were conducted by the instructor placing a word card on the table in front of a student, presenting the attending cue ("S, look here."), waiting for the attending response, delivering the task direction ("What word?"), and providing a 4-sec response interval. If the student responded correctly during the response interval, the teacher affirmed the correct response (e.g., "Good that is the word toaster."). If the student did not respond or responded incorrectly during the response interval, the teacher ignored the error, removed the word card, waited a 3-5 sec intertrial interval, and presented the next trial.

Daily probe trials. In addition to the probe conditions, daily probe trials were presented prior to beginning each group instructional session. The teacher approached an individual student and conducted one trial on each of the three target words currently receiving instruction. When the three individual probe trials were completed, the teacher told the student to go to the table for reading group. This continued until all students were seated at the table. Daily probe trials were conducted to assess whether a student's correct reading of a target word in the group arrangement was a function of having learned the word or a result of imitating other students' models of the correct response. Correct performance by all students on the three daily probe trials, as well as 100% correct responding during group instructional sessions, was required before moving to the next probe condition.

Review Trials. Beginning with instruction on the second set of target words, each student received one review trial on a previously learned target word to monitor maintenance of learned words. The review word was randomly selected from all previously learned words. No word was reassessed until all words received an equal number of trials. The trial presentation for review trials was identical to that used in the probe condition with the exception of the consequent event for errors. All incorrect responses were followed by an error correction procedure consisting of a mild verbal reprimand (e.g., "wrong") and a vocal model of the correct response.

Instructional Procedures

Group arrangements and general procedures. Twelve sight words representing known objects were targeted for instruction. These were selected by the classroom teacher based on students' IEP objectives. The 12 words were divided into four sets; each set consisting of three words. Each set was taught in a small group instructional arrangement using a 0-4-sec constant time delay procedure. All students were taught the same set of target words. Instruction continued until all students reached criterion level responding on each word in a set. That is, 100% unprompted correct responding during group instruction and 100% unprompted correct responding on the individual probe trials, one session using a continuous schedule of reinforcement (CRF), and one session with approximately every third correct response receiving descriptive verbal praise (VR3). The target words were randomly presented within each instructional session of 24 trials with six trials presented to each of the four students; two trials on each of the three target words across students. A student did not receive more than two consecutive turns and no word was presented on more than two successive trials. A general group attending cue (e.g., "Everybody, look.") was presented prior to each instructional trial.

In order to assess (a) whether students would learn to spell target words when the correct spelling was modeled by the teacher and (b) whether it made a difference if the teacher modeled the correct spelling before or after the student's reading of a target word, each word in a set was randomly assigned to one of three experimental conditions. In the "antecedent condition," the teacher spelled the target word aloud for the student in the presence of the word card prior to the task direction (e.g., "T-A-B-L-E." "What word?); in the "consequence condition," she modeled the correct spelling after the student's reading response as part of the consequent event (e.g."This is the word table, T-A-B-L-E."); and in the "no spelling condition," the teacher did not spell the word aloud. During the instructional and testing sessions, students were _not_ required to spell the words and they did _not_ receive reinforcement if correct spelling occurred.

Constant time delay (CTD). A constant time delay procedure with a 4-sec delay interval and a verbal model of the correct reading of the target word as the controlling prompt, was used to teach all words to criterion. Before beginning instructional sessions, the students were allowed to select a small prize to be delivered non-contingent of performance at the end of the session. This was in keeping with the classroom teacher's typical practice. The initial instructional session was conducted using a 0-sec delay interval. Prior to each instructional trial the teacher provided the group attending cue, "Everybody, look," and ensured attending responses from all students. Individual instructional trials consisted of the teacher securing the attention of the student whose turn it was by calling his name, presenting the task direction, and modelling the correct word name. If a word was assigned to the antecedent condition, the teacher spelled the target word aloud before presenting the task direction. Correct responses following the teacher's model (prompted corrects) were reinforced with descriptive verbal praise including confirmation of the correct response, in the antecedent and no spell conditions. If a word was assigned to the consequence condition, the teacher spelled the word aloud after providing the descriptive praise. Following incorrect responses after the teacher's model (prompted errors or no response errors), the instructor delivered a model of the correct reading of the target word in the antecedent and no spell conditions, and a model of the correct reading and spelling of the target word in the consequence condition.

Following the first instructional session, the delay interval was increased to 4 sec and remained there through all subsequent sessions. The trial format was identical to that presented during the 0-sec delay session. During 4 sec delay sessions, five types of student responses were possible: (a) the student could respond correctly before the prompt was delivered (unprompted correct); (b) the student could respond correctly after presentation of the controlling prompt (prompted correct); (c) the student could respond incorrectly before the prompt (unprompted error); (d) the student could respond incorrectly after the prompt (prompted error); or (e) the student could make no response following the prompt (no response error). The same consequent events were used in these instructional sessions as described for the 0-sec delay trials.

<u>Reliability</u>

<u>Dependent measure reliability estimates</u>. Reliability observations were conducted by a research associate twice weekly and at least once during each experimental condition on student responses to both the attending cue and task direction on each trial. A point-by-point method (number of agreements divided by number of agreements plus disagreements multiplied by 100) was used to calculate reliability.

<u>Procedural reliability estimates</u>. The instructor's fidelity with the experimental plan in conducting probe sessions and small group CTD instructional sessions also was assessed (Billingsley, White, & Munson, 1980). These measures included recording total session time, the teacher presenting the correct task stimulus, delivering the attending cue, securing an attending response from all students, modelling the spelling information at the appropriate time, presenting the task direction, waiting the specified delay interval prior to delivery of the prompt, delivering the appropriate consequent event, and waiting the specified intertrial interval. The instructor's behavior was observed

and compared to a description of the experimental plan. Procedural reliability estimates were calculated by dividing the number of actual instructor behaviors by the number of planned behaviors and multiplying by 100. Estimates were calculated for each condition, on each of the above behaviors, for each student in the group.

Results

Reliability

The mean percentage of agreement on student responding during probe and instructional conditions was 100% across all students in the group. In the probe conditions, the mean percentage of agreement on procedural reliability was 100% on all behaviors except delivery of the correct consequent event (mean=99.4%, range=92.3-100%). In CTD conditions, the mean percentage of agreement was 100% on all variables except waiting the specified delay interval (mean=99.6%, range=95.8-100%).

Effectiveness

The mean percentages of prompted and unprompted correct responses for all students to the four sets of three target words during probe and instructional conditions are shown in Figure 1. The percentages of correct responding for individual students during each probe condition are presented in Table 4. Prior to beginning the first three instructional conditions, the percentage of correct responding to the untrained target words was zero for all students in the group. The staggered introduction of the CTD procedure in each instructional condition resulted in criterion level responding on the target words for all students. In Probe IV, although one student responded at 100% correct on one of the target words assigned to the final word set prior to introducing CTD instruction, the mean percent of correct responding across students remained low (mean=12.5%, range=0-33.3%). Introduction of the CTD procedure in the fourth instructional condition resulted in criterion level responding for each of the students. In the final probe condition, criterion level responding was maintained for three of the four students. One student, Vance, required one additional individual probe session to attain 100% correct responding.

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Insert Figure 1 and Table 4 about here

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Efficiency

Efficiency data on the CTD prodecure across word sets are summarized in Table 5 and show the total number of trials, errors, percentage of errors, and direct instructional time through the group criterion. Because these efficiency measures were calculated through a group criterion rather than individual criterion, and the number of trials per student per instructional session was held constant, the number of trials and amount of direct instructional time through criterion in each instructional condition was the same across group members. Therefore, these data (trials and time to criterion) are inflated since they represent the slowest learners performance. The total number of instructional trials necessary to teach 12 words to each member of the group was 552 (mean=138, range=96-168 across word sets) and the total number of minutes was 127 (mean=32 min, range=19-46 min across word sets). In addition, the CTD procedure was near errorless in teaching the target words to all students. There were seven unprompted errors across the four instructional conditions with one student emitting a total of four errors (2.9%), one student making two errors (1.4%), one student one error (.7%), and the remaining student had zero errors through criterion. Because of the small number of errors in this study, no significant differences were found when the errors were analyzed by spelling condition for each student.

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Insert Table 5 About Here

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Incidental Learning

The mean percentage of correct responding to incidental information following instruction is presented in Table 6. In the initial screening pretest and in subsequent tests that occurred during probe conditions, i.e., preinstruction tests, correct responding on each of the oral and written spelling tests was zero across all students and all untrained target words. Results from the test sessions that occurred immediately following CTD instructions show that the mean percent of correct spelling was greater for words that were spelled by the teacher in the antecedent condition (mean=68.8%, range=50%-100%) as compared to words spelled in the consequence condition (mean=50%, range=25%-75%), and no spelling condition (mean=12.5%, range=0%-25%). There were no differences in performance on oral and written tests (i.e., if a student could orally spell the target word he could also produce the correct written spelling of the word with the reverse also being true). In the final posttest, the percentage of correct spelling was greater for the words presented in the consequent condition (mean=87.5%, range=75%-100%) as compared to those words assigned to the antecedent condition (mean=68.8%, range=50%-75%) and no spelling control condition (mean=31.2%, range=0%-50%).

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Insert Table 6 about here

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Generalization

Prior to instruction, the percentage of correct responding on each of the generalization tests, receptive identification of the target words and matching the written stimulus to a photograph of the referent, was 25% or less across students and target words. Following reading instruction on each set of target words, the students performed at 100% criterion across all words and both tests of generalization in the posttests immediately following instruction. Each student maintained 100% correct responding on these tests in the final assessment.

Discussion

This investigation taught sight words that represented common objects found in the students' environment in a small group arrangement using a CTD procedure. The words were selected based on a recommendation by the teacher that we target noun words for which (a) the students knew the referent and (b) the teacher could integrate into the reading program currently in use in the classroom. Five statements can be made in response to the findings of this investigation. First, the 4-sec CTD procedure was reliably implemented in a small group instructional arrangement by the classroom teacher. Second, CTD was an effective strategy in teaching each student the 12 targeted words. Third, the combination of CTD and small group instruction resulted in few errors to criterion for all students, i.e., students averaged .14 errors per word before the group criterion was reached. Fourth, all students learned some incidental information through observation (i.e., the spelling of the target words) when the teacher modelled the spelling as part of either the antecedent or consequent event. No student, however, learned more than 87.5% (mean=78%; range=75%-87.5%) of the spelling information. Fifth, each student demonstrated crossmodal transfer (Sidman, 1971) based on their performance on both receptive and comprehension tasks. Specifically, each student was able to receptively identify the written word after being taught to read the word. In addition, each student was able to match the word to its referent picture although these stimuli were never paired during instruction. This finding is consistent with the principle of transitivity discussed by Sidman and Tailby (1982).

Although the strength of this experimental design was that it allowed for a comparison between three treatment conditions during the same time period, a number of potential problems were identified. First, one student acquired one target word from the fourth word set in Probe IV. This may have been a result of repeated exposure to the target words in both the extended pretests or to the previous success of the student in "sounding out" simple consonant-vowel-consonant words. It should be noted, however, that each student received a maximum of six trials on each target word in each probe condition. Therefore, the mean percentage of correct responding per session for each instructional set was calculated on only two trials per word in the set. It is our recommendation that a minimum of five trials be conducted for each stimulus in order that one response does not influence performance by more than 20 percent.

The second potential problem is related to measures of efficiency. The group of students selected for this investigation was homogeneous by both age and diagnosis, and a group criterion was selected as the most parsimonious method for implementing the CTD procedure in the small group instructional arrangement. This allowed the teacher to use the same trial sequence for each student in each instructional session (e.g., she did not have sessions where one student was receiving 0-sec trials, one student was in a probe condition, and two students were at a 4-sec delay). Although the group criterion was easier to implement, it decreased the time efficiency (trials and minutes to criterion) of CTD instruction with this group of students. For example, the total number of trials to individual criterion across the four word sets and four students was 200 (4.2 trials per word) as compared to the 552 total trials (23 trials per word) required to reach the group criterion. This was a difference of 352 additional instructional trials (14.7 per word) in the investigation. Thus, an individual criterion is recommended over a group criterion when efficiency data are the primary dependent measures of an investigation. For the practitioner, a decision is necessary as to whether adopting a group criterion, which likely will decrease the efficiency of instruction for some students, is justified because of the ease in implementation. Variables the teacher will want to consider prior to deciding on an individual or group criterion include the number of students in the group, the previous learning rates of group members, the complexity of the instructional procedures, and the magnitude of the differences on efficiency measures between the two criterion models.

Third, in this investigation listening to other students respond correctly to identical target words (same-task, same-stimuli) may have contributed to the both the effectiveness and efficiency of CTD instruction in terms of the number of trials and errors through criterion. However, since each student was taught the same target stimuli, observational learning of other students' target behaviors could not be measured. The use of different sets of target words for each student (same-task, different-stimuli) might have increased the efficiency of the small group instructional arrangement relative to the total number of words acquired during instruction if students learned through observation (Cybriwsky, et. al., in press; Orelove, 1982).

This study was not however, an attempt to compare the efficiency of the constant time delay procedure to other sight word reading procedures used in group instructional arrangements. Direct comparisons of sight word reading programs have been made (cf. Brown, 1984) and future investigations will surely compare CTD to other effective reading procedures.

Although students were not afforded the opportunity to observe and acquire other group members' target words, observational learning did occur in the form of their acquisition of non-targeted spelling information. This information was incidental to the specific behavior that was being taught (Becker & Glidden, 1979). The correct spelling of the target word was modelled by the teacher during instructional sessions. Student demonstration of knowledge of this information was not required during instruction (Brown & Holvoet, 1982), but in the test sessions that occurred prior to and following instruction on the target words. A comparison of effectiveness was made between spelling the word before the trial (antecedent condition), to spelling the word after a response was emitted (consequence condition), to a no spelling control condition. Although acquisition of correct spelling of the target words was greater for words spelled in the antecedent condition, correct spelling of words from the consequent event and the no spelling conditions increased in the final posttest. Although this information was not modeled by the teacher subsequent to instruction for the consequent event word or never spelled for the third word, the increase in correct spelling of words from each of these conditions may have been a result of continued exposure to the written words in review and probe trials. The proximity of the spelling model to the written stimulus may have increased the probability that students would cue into the relevant characteristics (correct sequence of the letters) of the written stimulus and covertly practice the correct spelling of the words they were learning to read. In addition, although not at the same level of correct responding as the words spelled by the teacher, correct spelling of words assigned to the no spelling condition may have been a result of multitreatment interference. The students may not have been able to discriminate between spell/antecedent, spell/consequence, and no spell words. Therefore, once the students acquired the correct spelling of some words, generalization of correct spelling occurred to other target words in subsequent assessments. Anecdotally, at the beginning of the final posttest session, each student asked the experimenter, "Are we going to spell our words today?", although the reason for the assessment sessions was never specifically mentioned by the experimenter. In addition, the classroom teacher also reported that each of the students had a previous history of learning to spell the words they could already read.

In summary, because group instruction is an integral part of the delivery of instruction to students with disabilities, additional research is needed to replicate the effectiveness of this study in using not only CTD but other procedures demonstrated to be effective in one-to-one instructional arrangements with other populations and tasks. In addition, Browder, Schoen, and Lentz, (1987), reviewed the observational learning literature and found that "observational opportunities can be easily and readily provided in group formats" (p. 458) and that a variety of model formats designed to facilitate observational learning could be made a part of existing instructional arrangements. Additional research should focus on how group instructional variables such as number of members, number and kind of stimuli taught, turn-taking, prompting strategies, and so on, can be manipulated to facilitate varying types of observational learning, resulting in the increased efficiency of classroom instruction.

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Table 1

Description of Students

Gender Name	C.A.	Test	Score Diagnosis	Functioning Level
M Jay	8yr 4mo	Stanford Binet	IQ 52; speech and language delayed	Sequences # and # words to 100; counts by five; simple addition; tells time to 15 min; reads survival and CVC words;
M Vance	8yr 8mo	Stanford Binet	IQ 65 + or - 8; speech and language delayed	Counts in sets to 30; identifies #, # words to 100; simple add; tells time to 15 min; reads survival and CVC words; writes letters;
M Evan	8yr 2mo	Hiskey Nebraska Test of Learning Aptitude	IQ 68; speech and language delayed; cleft palate	Identifies coins; does addition with # line; identifies letters; reads basic survival and beginning CVC words; tells time to half-hr;
M Chad	7yr 10mo	Kaufman Assessment Battery for Children	composite score 73; hearing impaired; speech delayed	Identifies # and # words to 100; simple addition tells time to 15 min; identifies coins and values; reads survival and CVC words;

Table 2

<u>Target Words, the Order of Instruction, and Placement of Incidental Information across Students</u>

Instructional (Word Sets)	Target Words	Incidental Information
1	broom	spell antecedent
	table	spell consequences
	radio	no spelling provided
2	shovel	spell antecedent
	boat	spell consequences
	towel	no spelling provided
3	toaster	spell antecedent
	knife	spell consequences
	bathtub	no spelling provided
4	blanket	spell antecedent
	stove	spell consequences
	bucket	no spelling provided

Table 3

Description of Incidental and Generalization Tests and Order in Which They Occurred

Test Description / Selection Criteria	Word Set	Screening Pretest	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Posttest
Expressive: ENTRY								
Oral identification	1	X						
of picture/referent;	2	X						
("What is this?")	3	X						
100% across students	4	X						
Expressive: TARGET								
Oral identification	1	X	X	X	X	X	X	X
of written word;	2	X	X	X	X	X	X	X
("What word?")	3	X	X	X	X	X	X	X
0% across students	4	X	X	X	X	X	X	X
Receptive: GENERALIZATION								
Point identification	1	X	X	X				X
of written word;	2	X		X	X			X
("Show me ____.")	3	X			X	X		X
25% or < across students	4	X				X	X	X
Comprehension: GENERALIZATION								
Match written word to	1	X	X	X				X
picture/referent of	2	X		X	X			X
the word; ("Find same.")	3	X			X	X		X
25% or < across students	4	X				X	X	X
Expressive: INCIDENTAL								
Oral spelling of the	1	X	X	X				X
sight words;	2	X		X	X			X
("Spell _____.")	3	X			X	X		X
0% across students	4	X				X	X	X
Expressive: INCIDENTAL								
Written spelling of	1	X	X	X				X
the sight words;	2	X		X	X			X
("Spell _____.")	3	X			X	X		X
0% across students	4	X				X	X	X

Table 4

Mean Percentages of Correct Responding During Probe Conditions

Student	Word Set	Probe I	Probe II	Probe III	Probe IV	Probe V
Jay	1	0%	100%	100%	100%	100%
	2	0%	0%	100%	100%	100%
	3	0%	0%	0%	100%	100%
	4	0%	0%	0%	33%	100%
Vance	1	0%	88.7%	100%	100%	90%
	2	0%	0%	100%	100%	95%
	3	0%	0%	0%	100%	85%
	4	0%	0%	0%	0%	86.4%
Evan	1	0%	91.7%	100%	100%	100%
	2	0%	0%	100%	91.7%	100%
	3	0%	0%	0%	100%	100%
	4	0%	0%	0%	0%	100%
Chad	1	0%	100%	100%	100%	100%
	2	0%	0%	100%	100%	100%
	3	0%	0%	0%	100%	100%
	4	0%	0%	0%	0%	100%

Table 5

The Measures of Efficiency Through Criterion, Across Students and Instructional Conditions

Word Set	Efficiency Measures			
	Number of Trials	Number of Errors	Percent of Errors	Minutes of Instruction
Set 1				
mean	42	1	2.4%	
range	42-42	0-2	0%-4.8%	
Totals Across Students	168	4	2.4%	46
Set 2				
mean	24	1	1%	
range	24-24	0-1	0%-4.2%	
Totals Across Students	96	1	1%	19
Set 3				
mean	36	1	.7%	
range	36-36	0-1	0%-2.8%	
Totals Across Students	144	1	.7%	27
Set 4				
mean	36	1	.7%	
range	36-36	0-1	0%-.7%	
Totals Across Students	144	1	.7%	35
Totals Across Instructional Conditions and Students				
mean	138	1.8	1.3%	32
range	96-168	0-2	0%-4.8%	19-46
Totals	552	7	1.3%	127

Table 6

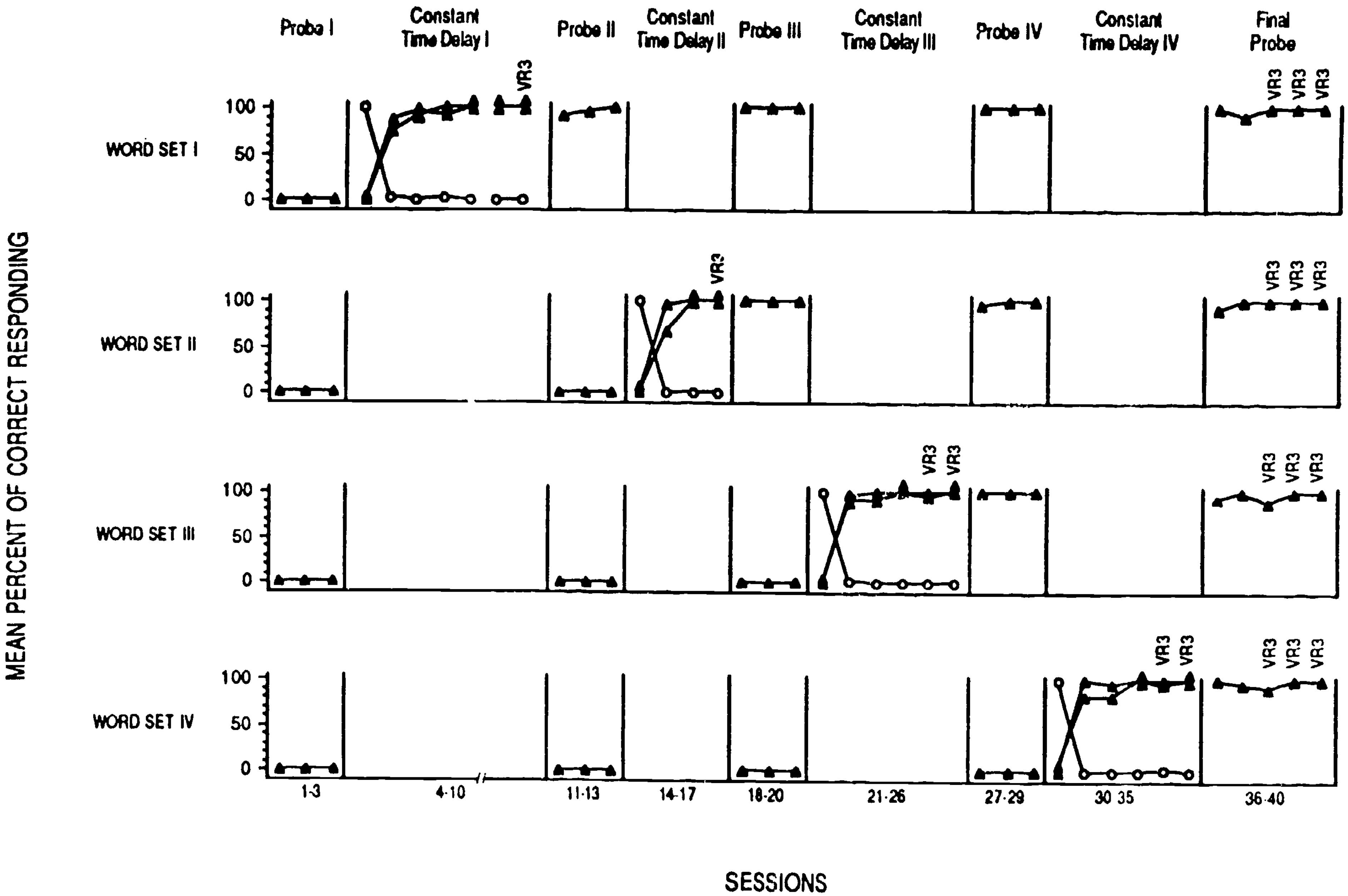
The Mean Percentage of Correct Responding to the Incidental Spelling Tests Across Students

Teacher Spelling	Word Set	Incidental and Written Spelling Conditions: Screening Pretest	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Posttest
antecedent	1	0%	0%	100%				100%
consequence	1	0%	0%	50%				100%
no spelling	1	0%	0%	25%				25%
antecedent	2	0%		0%	50%			50%
consequence	2	0%		0%	50%			100%
no spelling	2	0%		0%	0%			50%
antecedent	3	0%			0%	50%		50%
consequence	3	0%			0%	75%		75%
no spelling	3	0%			0%	0%		0%
antecedent	4	0%				0%	75%	75%
consequence	4	0%				0%	25%	75%
no spelling	4	0%				0%	25%	50%

Totals	Pretest mean	Pretest range	Probe Tests mean	Probe Tests range	Posttest mean	Posttest range
antecedent	0%	(0%-0%)	68.7%	(50%-100%)	68.7%	(50%-100%)
consequences	0%	(0%-0%)	50%	(25%-75%)	87.5%	(75%-100%)
no spelling	0%	(0%-0%)	12.5%	(0%-25%)	31.2%	(0%-50%)

Figure Caption

Figure 1. The mean percentages of unprompted and prompted correct sight word reading responses using a constant time delay procedure for the group. The closed triangles indicate correct responses during probe conditions. The open triangles indicate unprompted correct responses and the open circles indicate prompted correct responses during instructional conditions.


Probe I
Constant Time Delay I
Probe II
Constant Time Delay II
Probe III
Constant Time Delay III
Probe IV
Constant Time Delay IV
Final Probe
MEAN PERCENT OF CORRECT RESPONDING
WORD SET I
WORD SET II
WORD SET III
WORD SET IV
100
50
0
VR3
1-3
4-10
11-13
14-17
18-20
21-26
27-29
30-35
36-40
SESSIONS

Appendix H

Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Griffen, A. K. (in press a). Teaching chained tasks in dyads: Acquisition of target and observational behaviors. Journal of Special Education.

Teaching Chained Tasks In Dyads: Acquisition of Target and Observational Behaviors[1]

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Running Head: TEACHING IN DYADS

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Abstract

This investigation used a multiple probe design to evaluate the use of a constant time delay procedure in a small group instructional arrangement. Two pairs of two students (i.e., dyads) with moderate mental retardation were taught domestic and vocational chained tasks. Tasks for each dyad were divided so that one student of the dyad was taught the first part of the task, and the other student was taught the second part. Interactions between members of each dyad were specifically prompted so that students delivered both antecedent (i.e., attentional cue), and consequent (i.e., reinforcement) events to their dyad member. Students observed each other learning their respective part of the task and then were assessed on their ability to perform both parts of the task (i.e., the part taught directly and the part taught to the other member of the dyad). The results indicate that (a) constant time delay was effective in teaching chained tasks in dyads, and (b) all students learned a substantial amount of the tasks they were not directly taught but that they observed being taught to the other member of their dyad. These findings are discussed in terms of designing effective and efficient instruction for students with moderate handicaps.

Teaching Chained Tasks in Dyads: Acquisition of Target and Observational Behaviors

The time delay procedure is a response prompting strategy in which stimulus control is transferred from a controlling response prompt to a target stimulus. Two types of time delay procedures have been studied: progressive and constant time delay (Handen & Zane, 1987). Progressive time delay involves simultaneously presenting the target stimulus and controlling prompt for a specified number of trials. Following these simultaneous trials, the time between the stimulus and prompt is gradually increased over trials (Touchette, 1971). Constant time delay (CTD) also involves the simultaneous presentation of the controlling prompt and stimulus. However, following these trials, the time between the stimulus and prompt is increased to a fixed interval for all remaining trials (Kleinert & Gast, 1982). CTD has been used effectively to teach students with a wide range of handicapping conditions discrete skills such as matching (McIlvane, Withstandley, & Stoddard, 1984), sight word reading (Gast, Ault, Wolery, Doyle, & Belanger, 1988), manual signing (Browder, Morris, & Snell, 1981), and spelling (Stevens & Schuster, 1987). It also has been used to teach chained tasks such as cooking (Schuster, Gast, Wolery, & Guiltinan, 1988), banking (McDonnell & Ferguson, 1989), and laundry skills (Miller & Test, 1989). Previous research has shown CTD to be an efficient strategy. When compared to the system of least prompts procedure, CTD was more efficient in teaching both discrete and chained tasks on measures such as trials, errors, and instructional time to criterion (Ault, Wolery, Gast, Doyle, & Eizenstat, 1988; Doyle, Wolery, Gast, Ault, & Wiley, 1990; Wolery, Ault, Gast, Doyle, & Griffen, 1990). When compared to a most-to-least prompting strategy in teaching chained tasks mixed results were found. Miller and Test (1989) found delay to be more efficient in teaching laundry skills, but McDonnell and Ferguson (1989) found the most-to-least strategy to be more efficient in teaching banking skills.

All of these tasks were taught to students within an one-to-one instructional arrangement. An alternative to one-to-one instruction that has not been well researched with CTD, is small group instruction with students with moderate and severe handicaps. The use of small group instruction may hold several advantages over one-to-one instruction (Reid & Favell, 1984). First, small group instruction diminishes the demands on teacher time since more than one student can be taught simultaneously. Second, generalization to less restrictive settings is enhanced since group instruction more closely represents regular and vocational instructional settings (Fink & Sandall, 1978). Third, students have an opportunity to learn appropriate interaction skills (Alberto, Jobes, Sizemore, & Doran, 1980). And fourth, the efficiency of instruction may be increased since students may learn behaviors taught to their peers through observation (Browder, Schoen, & Lentz, 1986).

When teaching chained tasks, small group arrangements may cause logistical problems. However, Schoen and her colleagues have conducted two studies using dyad instruction. Schoen and Sivil (1989) demonstrated that the efficiency of instruction can be enhanced through observational learning. They compared a CTD procedure and a system of least prompts procedure in teaching self-help skills to 4 pairs of preschoolers with developmental disabilities. One member of a dyad was taught a skill, while the other member served as an observer. A teacher verbally instructed the observer to attend, praised attending, and provided intermittent reminders to attend. The results indicated that both procedures were effective in teaching self-help skills, but the CTD procedure was more efficient that the system of least prompts procedure. Observing

substantial amount of the chains taught to the other
ad.

and Suppa (1988) compared the effects of decreasing
uated guidance in teaching self-care skills to dyads of
wn Syndrome. One member of the dyad was directly taught
other member observed. As in the Schoen and Sivil (1989)
member was cued by the teacher to watch the instruction
the end of the chain. The results indicated that both
ures were effective and that the observing student
ble amount of the skills without direct instruction. In
es, however, the observing students were probed daily on
their dyad member. This frequent assessment of
ing may have communicated to the observer that they were
e skills. In the Schoen and Sivil (1989) study,
rovided during daily probes, but this did not appear to be
en et al. (1988) study.

this study was to extend the previous research by
s of the CTD procedure in teaching chained tasks in dyads
taught a different "half" of the response chain. This
nsure that each student in the dyad received direct
of the response chain and that each student was the
rather than present multiple trials as Schoen et al.
e, daily, total-task trial was used in each instructional
ed purpose was to assess observational learning when an
strategy was used that involved having one member of the
and having the observing student deliver the token to the
of the chain. This was different from the research by

Schoen and her colleagues because they used a teacher to cue and reinforce the attention of the observer.

Methods

Participants and Setting

Four students (1 male, 3 females) who were enrolled in a self-contained public school class for students with moderate mental retardation participated. The members of one dyad were Colin and Alma; the other dyad consisted of Tara and Sally. Students were selected to be paired in dyads based on teacher reports of students who learned at similar rates and had previously been grouped during instruction.

Colin, age 12 years, 5 months, was diagnosed as a student with Down syndrome and an unilateral moderate hearing loss corrected with a hearing aid. He received a full scale IQ score of 33 on the Stanford-Binet Intelligence Scale and had a mental age of 3 years 1 month (Terman & Merrill, 1973). He spoke in 2-3 word phrases and had a severe articulation disorder. Colin was able to read most community-sign words, match and fold socks, and set a table, but was unable to independently locate and purchase an item in a grocery store. Alma, age 11 years, 5 months, was diagnosed as a student with Down syndrome. She received a full scale IQ score of 42 on the Stanford-Binet Intelligence Scale and a mental age of 4 years, 4 months (Terman & Merrill, 1973). Alma spoke in 2-5 word phrases. She was able to read second grade level Dolch words, and could independently take and communicate a message to another person. She was unable to make a drink from a powdered mix or tie her shoes. Tara, age 10 years, 8 months, received a full scale IQ score of 42 on the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). She was diagnosed as being in the moderately mentally retarded range and having a controlled seizure disorder. She communicated by using manual signs in mailing, (c) cleaning overheads, and (d) cleaning a sink. These tasks were selected from interviews with the teacher concerning chained tasks she considered beneficial for the students to learn that could be easily taught in the classroom. The task analyses and materials used for each of the tasks are presented in Table 1. For each task taught, 5 x 1.5 cm plastic chips were used as tokens and a plastic box was used to hold a variety of back-up reinforcers (e.g., stickers, candy, charms, coins, etc.).

Insert Table 1 about here

Procedures

General Procedures. Instructional sessions were conducted in dyads (i.e., 2 students were taught by 1 teacher). One instructional session with each dyad occurred every school day if both students in the dyad were present. A CTD procedure was used to teach the chained tasks in a total task format (Kayser, Billingsley, & Neel, 1986). Each chained task taught was divided into two parts. One member of the dyad was taught the first part of the task while the second member observed, and then the second member was taught the second part while the first member observed. The order of instruction was counterbalanced so that the same student that learned the first part of task 1, learned the second part of task 2 and vice versa. Each dyad learned one task to criterion before another was taught. The steps of the task directly taught to a student were defined as that student's target steps and were the observational learning steps for the observing student. Criterion for each member of the dyad on their part of the task was 100% unprompted correct responses for one session on a continuous reinforcement schedule (CRF) followed by both members of the dyad simultaneously obtaining 100% correct unprompted responses for two consecutive sessions on a variable ratio three schedule (VR3).

Probe Procedures. To assess a student's ability to perform both target and observational steps of each task, individual probe sessions were conducted before instruction occurred on any of the chained tasks and the day after criterion was met by the dyad on each successive task. For each probe condition at least 3 probe sessions were conducted for each student or until data were stable. The first session of a probe condition for each student consisted of one trial on all four tasks, followed by 2 sessions of 1 trial on the task just taught and 1 trial on the task to be taught next. During the initial probe condition, since no tasks had been taught, the second and third probe sessions consisted of 1 trial each on the first two tasks to be taught. A correct response was defined as the student initiating a correct response within 5 sec and completing the response within 10 sec. Three specific types of incorrect responses were recorded. Duration errors were defined as the student initiating a correct response within 5 sec but not completing the response within 10 sec. Topography errors were defined as the student initiating a correct response within 5 sec but incorrectly completing it within 10 sec. Sequence errors referred to responses in which the student initiated a step within 5 sec that was out of the correct sequence according to the task analysis. No responses were defined as the student not initiating a response within 5 sec. During probe trials, the teacher arranged the materials for the task, said "Are you ready?", presented the task direction specific to each task, and waited 5 sec for the student to respond on step 1 of the task analysis. For each step in the task analysis if a correct response occurred, the teacher recorded the response, said "Keep going", and waited 5 sec for the student's response on the next step of the task analysis. If an incorrect response occurred, the teacher interrupted the response, completed the correct response behind a screen or while the student was turned away, placed the correct materials before the student, said "Keep going", and waited 5 sec for the student to respond on the next step of the task analysis. If a no response occurred, the teacher completed the step, said "Keep going", and waited 5 sec for the student to respond on the next step of the task analysis. The teacher provided descriptive verbal praise for looking at materials and attempting the task on a VR3 schedule of reinforcement to maintain the student's attention during the sessions. At the end of each task, the teacher said, "Good job (performing the task)." and gave the student one token. The teacher then waited an intertrial interval of at least 30 sec and arranged the materials for the next task. At the end of the probe session, the students exchanged their tokens for a back-up reinfor r. This probe procedure yielded data on the student's ability to perform each individual step in the task analyses.

Constant time delay procedure. Each CTD instructional session involved 1 trial on one task presented in a total task sequence. In addition, an intersequential group strategy was used during the CTD instructional sessions in which interactions between the dyad members were specifically prompted (Reid & Favell, 1984). The initial session was conducted using a 0-sec delay and continued until both students simultaneously received 100% correct prompted responses for 1 session. All subsequent sessions were conducted using a 5-sec delay. The controlling prompt for each step in the task analysis was the teacher simultaneously providing a model nd a verbal description of the step. On 0-sec delay trials, the teacher arranged the materials for the task, and asked both students, "Are you ready?". Following an affirmative response, the teacher prompted student A (i.e., the student learning the first part of the task) to say or sign to student B (i.e., the student learning the second part of the task) "Watch me"; prompted student B to say or sign to student A, "O.K."; and then provided the task direction to student A. The teacher then immediately provided the prompt for step 1 of the task analysis. After providing consequences for step 1, the teacher immediately provided the prompt for the next step in the task and continued this process for all steps in student A's part of the task. The teacher then prompted student B to hand student A a token and say or sign "Good work." The teacher then repeated these procedures with student B serving as the performer and student A as the observer. Students were allowed to trade their tokens for a back-up reinforcer when the entire task was completed.

On 5-sec delay trials, the instructor arranged the materials for the task, asked both students, "Are you ready?", and waited for an affirmative response. The teacher then prompted student A to give the attending cue to student B, prompted student B to reply, and then immediately provided the task direction to student A. The teacher now waited 5 sec (i.e., counted silently "1001," "1002," etc.) before providing the prompt for step 1 of the task analysis. After providing consequences for step 1 of the task analysis, the teacher again waited 5 sec before providing the prompt for step 2 and so on until all steps of the task were completed. The process continued as in 0-sec delay trials for student B except the teacher waited 5 sec before providing the prompt on all steps in the task analysis. At no time during the sessions did the teacher direct the observing student to attend to the target student being instructed on their part of the task.

Two types of correct responses were recorded: unprompted corrects and prompted corrects. Unprompted correct responses were recorded when the student initiated a step of the task analysis before the prompt and completed it correctly within 10 sec. Prompted correct responses were recorded when a student initiated a response within 5 sec after the prompt and completed it correctly within 10 sec.

Three types of incorrect responses were recorded: non-wait errors, wait errors, and no responses. Non-wait errors were defined as the student initiating the response before the prompt but (a) not completing it within 10 sec (i.e., incorrect duration); (b) incorrectly completing it within 10 sec (i.e., incorrect topography); and (c) initiating a step but not in the correct sequence (i.e., incorrect sequence). Wait errors were defined as the student initiating a response within 5 sec after the prompt but (a) not completing it within 10 sec (i.e., incorrect duration), (b) incorrectly completing the response within 10 sec (i.e., incorrect topography), or (c) initiating a step but not in the correct sequence (i.e., incorrect sequence). A no response error was scored when the student did not initiate any response within 5 sec after the delivery of the prompt.

When a correct response occurred, the teacher said, "Good" and described exactly what the student did (e.g., "Good, you put the pants on the table."). When a non-wait error occurred, the teacher interrupted the response, said "Wait, let me show you if you don't know," modeled the correct response, and allowed the student to imitate the model. When a no response occurred, the teacher said, "Let me show you if you don't know," modeled the correct response, and allowed the student to imitate the model.

Massed trial training. Following probe sessions, when the student's ability to perform both the target and observational steps of the trained tasks had been measured, if a student did not obtain at least 75% correct responses on the observational steps of a task, then the observational steps were directly taught to that student so he or she would be able to perform the entire task. Massed trial training was conducted using CTD instructional procedures in a 1:1 arrangement on the entire task. The student continued learning another task during dyad training at another time during the day. In massed trial training, the teacher delivered at least 2 trials per session until the student reached the criterion of 1 trial of 100% correct unprompted responses on a CRF schedule followed by 2 consecutive trials of 100% correct unprompted responses on a VR3 schedule for all steps of the task analysis.

Review trial procedures. Following Probe II, review trials were conducted on the tasks taught to maintain criterion level responding. At a time other than instructional sessions, the teacher conducted one review trial a day on one task with one student. Review trials were conducted exactly like 5-sec CTD instructional trials except in a 1:1 instructional arrangement. Each individual student received a review trial either (a) once every other day when only one dyad had met criterion on task 1, or (b) once every fourth day when both dyads had met criterion on task 1.

Experimental Design

A multiple probe design across tasks and replicated with 4 students was used to evaluate experimental control (Horner & Baer, 1978; Tawney & Gast, 1984). Experimental control was demonstrated when student responding on targeted steps increased only following CTD instruction and did not increase on untrained steps prior to intervention. Experimental conditions were implemented in the following sequence: Individual probes conducted on all four tasks scheduled to be taught; individual probes conducted on the first two tasks to be taught; one part of a task taught to each student in a dyad using the CTD procedure until criterion was met; individual probes conducted on all four tasks scheduled to be taught; individual probes conducted on the task just taught and the task scheduled to be taught next; this sequence continued until each dyad learned two complete tasks.

Reliability

Reliability assessments on student responding and procedural fidelity (Billingsley, White, & Munson, 1980) were collected at least once each week or at least once during each experimental condition. A point-by-point method (the number of agreements divided by the number of agreements plus disagreements multiplied by 100) was used to calculate interobserver agreement percentages. For procedural reliability, the following teacher behaviors were measured: giving the attentional cue "Are you ready?", ensuring an affirmative response, prompting student to deliver attentional cue (time delay condition only), prompting student to reply affirmatively to attentional cue (time delay condition only), providing the task direction specific to each task, waiting the correct response interval, providing the prompt when appropriate, providing the correct consequences, waiting the intertrial interval, providing a token (probe condition), prompting student to praise and provide a token (time delay condition). Procedural reliability estimates were calculated by dividing the number of correct investigator behaviors that the observer recorded by the number of planned behaviors which should have been emitted in the session, and multiplying by 100 (Billingsley et al., 1980).

Results

Reliability Results

Reliability assessments on both student responding and procedural reliablity were conducted during 45%, 71%, 50%, and 50% of the probe sessions for Colin, Alma, Tara, and Sally, respectively. During CTD sessions, reliability assessments were conducted during 48% of the sessions for the Colin/Alma dyad and 42% of the sessions for the

Tara/Sally dyad. The mean percent of agreement on student responding during probe sessions was 94.8%, 95.6%, 91.6%, and 95.4% for Colin, Alma, Tara, and Sally, respectively. During CTD instruction, student responding reliability was 99.6% for the Colin/Alma dyad and 99.2% for the Tara/Sally dyad. During probe sessions across all students, procedural reliability was 100% for the behaviors of giving the attentional cue, giving the task direction, and providing the token. Other mean (and range) reliability estimates across all students were 99.7% (range 99.1-100%) for waiting the response interval, 95.8% (range 94-97.9%) for providing the correct consequences, and 93.5% (range 80-100%) for the teacher waiting the intertrial interval. During CTD training, across both dyads, procedural reliability was 100% for the behaviors of the teacher giving the attentional cue and the teacher prompting the observing student to praise the performing student. Other mean (and range) reliability estimates across both dyads were 98.7% (range 97-100%) for prompting the performing student to deliver the attentional cue, 97.4% (range 95-100%) for ensuring an attentional response, 96.1% (range 94-98%) for giving the task direction, 97.8% (range 97-99%) for waiting the appropriate delay interval and providing the prompt, and 98.5% (range 96-99%) for providing the correct consequences.

<u>Effectiveness of Constant Time Delay</u>

The percentage of correct responding on target steps for Colin, Alma, Tara, and Sally during probe and constant time delay conditions are shown in Figures 1, 2, 3, and 4 respectively. Two of the four tasks were taught to each dyad and instruction was then stopped due to the end of the school year. Since the probe procedures allowed for the student's response to each step of the task anlaysis to be assessed, all students were able to perform some of their target steps prior to intervention on the two task analysis that were taught. On the two tasks taught, for each student, the CTD procedure was effective in raising responding to criterion levels. During probe conditions immediately following training, students maintained high levels of responding on the target steps just learned. Probe data immediately following training ranged from 92-100% for Colin, 50-100% for Alma, 86-100% for Tara, and 75-100% for Sally.

Insert Figures 1, 2, 3, and 4 about here

Modifications of the procedures as written were needed to raise responding to criterion levels for all 4 students. During the first few sessions of the eggnog task, Colin and Alma made 25% or greater unprompted incorrect responses for 3 sessions; therefore, wait training procedures were implemented until they were able to consistently wait 5 sec for a prompt. Wait training procedures (Snell & Gast, 1981) were conducted in individual sessions using a chained task that students already had the response requirements to perform. Following wait training procedures, both Colin and Alma had 1 step in which they consistently waited for the prompt, while they responded independently (i.e., correct unprompted responses) on all other steps in the task analysis. For these steps, the teacher reminded them before the session about the step they needed to remember. This was successful with both students, and the reminder was removed before probe procedures were implemented. Finally, when Alma's unprompted correct responses did not increase for 3 consecutive sessions during the eggnog task, a differential reinforcement procedure was used. Receipt of the token was made contingent upon an increase in unprompted corrects from one day to the next. This modification did not increase unprompted correct responding, and was combined with an additional prompt in which if Alma had not responded within the 5 second delay interval, the teacher said, "If you know what to do, do it.", and then waited 5 sec and provided the model prompt if needed. This was successful in raising responding to criterion levels on the eggnog task and was also successful when it was used with Alma again on the cleaning overhead task.

Modifications also were needed for Tara and Sally. First, Tara and Sally did not accurately imitate the teacher's model (i.e., controlling prompt) on some steps of the preparing envelope task during 0-sec delay trials. When this occurred for 2 consecutive 0-sec delay sessions, the teacher provided a physical prompt for that step of the task analysis and used a physical prompt as the controlling prompt for that step throughout intervention. Second, when errors occurred consistently on a given step (two steps for Sally and one for Tara), the teacher provided one trial in one session at the 0-sec delay on those steps, and then she returned to the 5-sec delay. This was effective with both students on one step. Sally required a physical rather than model prompt on the second step where she was performing inconsistently. And third, during instruction on preparing envelopes, Tara was able to closely approximate putting the mailing label in the middle of the envelope, but was not performing the skill with enough accuracy to meet the response definition. Therefore, immediately prior to this step, the teacher prompted Tara to point to the place on the envelope where the mailing label was to be put. This extra prompt was successful in teaching Tara to correctly place the label, and it was faded before probe conditions were implemented.

The number of sessions, the percentage of errors, and the number of minutes of direct instructional time through criterion for all students are presented in Table 2. The figures for individual students were based on data from the first session of training until that student met the VR3 criterion. The figures for the dyads represent data from the first session of training until both students in the dyad simultaneously met the VR3 criterion. The two dyads learned the tasks in a mean of 21.25 sessions (range 15-28), in an average 173 (range 99-213 minutes) of minutes of direct instructional time, and with a mean percentage of errors of 8.4 (range 5.3-12.1%). Across all tasks and all students, 53% of the errors were topography errors, 41% were sequence errors, and 6% were duration errors. In terms of dyads, the Colin/Alma dyad had more sequence errors (69%) than topography errors (22%), while the Tara/Sally dyad had more topography errors (68%) than sequence errors (24%).

Insert Table 2 about here

In addition, across all tasks and students, when each target step was analyzed individually, at least two target steps were learned without error whereas other steps had a high percent of error during instructional sessions. Specific target steps in which errors during instructional sessions were above 20% included step 7 (30% errors) of the eggnog task and steps 16 (26% errors) and 22 (26% errors) of the overhead task for Alma, step 8 (53% errors) of the folding clothes task and steps 10 (36% errors) and 11 (29% errors) of the envelope task for Tara, and step 10 (33% errors) of the folding clothes task and step 6 (36% errors) of the envelope task for Sally. All individual target steps for Colin were learned with 9% errors or less.

Observational Learning

The mean percent of unprompted correct responses on observational steps that occurred during the probe immediately prior to intervention and immediately following intervention are presented in Figure 5. These data represent the steps that each student was not directly taught but that they observed being taught to the other member of their dyad. All students, except Colin on the cleaning overhead task, were able to independently perform some of their observational steps prior to training. Following training, all students' ability to perform observational steps increased, ranging from a net gain of 38-80% (X = 62.75%). Only 1 student, Sally, on the preparing envelope task required massed trial training following intervention since she was able to perform an average of only 50% of the observational steps following dyad intervention. After massed trial training, subsequent probe data indicated that Sally was able to perform 88% of the observational steps on the preparing envelope task.

Insert Figure 5 about here

Discussion

The purpose of this study was to (a) evaluate the effectiveness of a CTD procedure in teaching chained tasks in a dyad when each member was taught half of the steps, and (b) to evaluate the use of the CTD procedure and an intersequential group strategy used in dyads on observational learning. Results indicated that CTD was effective in teaching chained tasks in dyads of students with moderate mental retardation. This supports and extends previous research in which CTD has been shown to be effective in teaching chained behaviors in one-to-one instructional settings (Schuster, et al. 1988; Miller & Test, in press) and in small group arrangements (Schoen & Sivil, 1989; Schoen et al., 1988).

The students learned their target steps with a mean percent of errors of 9.3 (range 2.4-16.8%). These percentages are slightly higher error rates than some that have been reported in time delay investigations (Handen & Zane, 1987); however, three different types of errors were recorded which could have contributed to the higher error percentages. Overall, 41% of the errors that occurred during training were sequence errors. In this investigation, students were required to perform steps in the same sequence as written in the task analysis to be considered correct. It was critical that some steps be performed in a specific sequence so that the final product was correct, however other steps could have been performed in any order and the task would have still been finished correctly. The advantage of teaching in a sequence was that procedures were more parsimonious and recording students' behavior was less complex. The disadvantage, however, is that students may have been considered incorrect even though they performed a behavior correctly. The number of sessions to criterion may have been lower if these non-critical sequence errors had been recorded as correct. This issue of teaching using a fixed sequence, and the procedural complexity questions which surround it, warrant further investigation.

For all students, observational learning occurred although students were not directly instructed or reinforced to attend by the teacher. All students learned a substantial percentage of steps without being directly taught those steps. This finding is surprising given the functioning level of the students involved, the minimal cues to prompt students to learn the steps taught to their peer, and the infrequent assessment of their performance on observational learning steps. Previous research (e.g., Schoen et al., 1988; Schoen & Sivil, 1989) with observational learning of chained tasks in dyads used daily monitoring of the observational behaviors. This daily measurement may have cued students to learn those steps taught to their peer in the dyad. However, in this study, daily measurement of observational learning steps did not occur; in fact, these behaviors were only assessed during probe conditions (prior to the instructional condition and after the dyad had met criterion on the task). Further, students in this study were not cued by the teacher to attend to the observational learning steps and were not reinforced by the teacher for attending to those steps. In addition, multiple daily trials on the chain were not needed. Previous research (Schoen et al., 1988) used multiple trials per session; the current investigation used a single total-task trial each day. It is possible that in this study some learning of nontarget steps occurred due to stimulus generalization. Some tasks required similar responses in both parts of the task. For example, opening and closing a variety of containers was taught across both parts of the making eggnog task. However, students were required to perform this response in the correct sequence and many other observational responses were learned that were not similar to target responses. Thus it seems likely that observational learning was responsible for much of the acquisition of observational steps that occurred. Future research should examine requiring students to emit attending responses versus not requiring attending responses on acquisition during observational learning trials, and should examine the parameters of attending that facilitate observational learning. For example, comparison of teacher and peer delivered attentional cues and reinforcement needs study.

In this investigation, an intersequential group strategy allowed for prompted interactions between group members. Over sessions, the teacher provided only the amount of prompting necessary for students to deliver an attentional cue at the beginning of each half of the chain, and praise and tokens to each other at the end of the chain. Initially, the teacher needed to model the behaviors to control the student's response, but later an indirect verbal cue such as, "What do you say to Tara?", was sufficient in controlling the behavior. Finally, no prompt was necessary during some sessions for Colin and Alma who independently prompted or reinforced one another. Although considerable observational learning occurred, it cannot be attributed soley to intersequential group interactions. Future research should examine the effects of the intersequential group strategy on the acquisition of observational steps and the parameters of the strategy which lead to the most effective and efficient learning.

In this investigation, the task was structured so that students learned a part of the same task that was divided into 2 parts. Other ways to structure the task could be examined in terms of their effects on target and observational learning. Students could be taught two separate chains that occur consecutively in a routine. For example, one student could be taught to set the table, and another to place the food on the table. The students' behavior could be assessed on their ability to perform the entire routine. Second, one student could be taught an entire skill while the other student or multiple students observed. These observing students could be assessed on their ability to perform the task (cf. Schoen et al., 1988). Third, a task could be divided into separate parts all of which are taught to each student but on alternating days, so that some days the student is learning a part of the skill that he observed being taught to another student on another day. Anc fourth, research needs to examine the optimal number of students in a group which can learn observational and target information on chained tasks. Most previous research on observational learning focuses on discrete responses.

Four implications of this investigation exist for classroom teachers. First, the CTD procedure can be used effectively in dyads of students with moderate mental retardation to teach chained tasks. Second, an experienced teacher was able to implement the procedure in dyads reliably. Third, when two students need to learn the same chained task, each of them can be taught part of the task and considerable observational learning is likely on the steps taught to a student's peer. This may result in a considerable reduction of instructional time each day because the chain only needs to be performed one time. Some chained responses occur only once during the natural flow of a day. Thus, the current investigation suggests that the single natural time for performing a response chain can be used to teach two students simultaneoulsy by having each student perform part of the chain. An important area for additional research is the effects of dyad instruction on chained tasks when implemented in community-based settings. The current investigation occurred in a classroom, and the application of the procedure to community-based instruction remains an unexplored area. Fourth, promoting observational learning of chained tasks in dyads may require minimal programming. In the current study, each student instructed their peer to watch them perform their parts of the chain, and at the end of the chain praised them and gave them a token for watching. It should be noted, that some of the students learned to independently cue observation and deliver the praise/token. Further, the praise and tokens were not presented contingent upon observation, and no cues to observe were provided during the chain.

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Table 1

Behaviors in Each Response Chain and Materials Used

Skill Sequence of Responses	Materials
Making eggnog	
1. Open egg carton	Quart of milk
2. Remove 1 egg, crack into bowl, throw shells in trash	Carton of eggs
3. Close egg carton	Vanilla
4. Open sugar container	Nutmeg
5. Measure two tablespoons sugar, place in bowl	Mixing bowl
6. Close sugar container	1 cup measuring cup
7. Beat mixture with eggbeater, place beater on rag	1 tablespoon
8. Open milk	Eggbeater
9. Measure 1 cup milk, pour in bowl	2 glasses
10. Close milk	
11. Open vanilla	
12. Measure 1/4 teaspoon vanilla, pour in bowl	
13. Close vanilla	
14. Mix with eggbeater, place eggbeater on rag	
15. Pour mixture into two glasses	
16. Open nutmeg	
17. Sprinkle nutmeg on top of eggnog in two glasses	
18. Close nutmeg	
Cleaning overheads	
1. Get overhead and white sheet, place on table	8 x 11' inch overhead transparancies
2. Separate overhead and white sheet	8 x 11' white paper
3. Get sponge, place on table	Paper tray to hold transparancies and paper
4. Get paper towels, place on table	Sponge
5. Get bowl, go to sink, fill bowl with water, place on table	Roll of paper towels
6. Place sponge in water	Bowl
7. Wring out sponge	
8. Hold overhead with one hand, wipe with sponge	
9. Place sponge in water	
10. Wring out sponge	
11. Hold overhead with one hand, wipe with sponge	
12. Place sponge in water	
13. Wring out sponge, place on table	
14. Remove one papertowel from roll	
15. Hold overhead with one hand, wipe with papertowel	
16. Pick up overhead, wipe table under overhead with towel	
17. Turn overhead over, place on table	
18. Wipe back side of overhead with papertowel	
19. Place white sheet behind overhead	
20. Place overhead and sheet in basket	
21. Throw papertowel in trash.	
22. Take bowl to sink, empty water, place bowl on shelf	
23. Place sponge on shelf	
24. Place papertowel on shelf	

Table 1 continued

Skill Sequence of Responses	Materials
Making fudge shake	
1. Get jar, place on table	Quart of milk
2. Get measuring cups/place on table	Chocolate syrup in squeeze bottle
3. Get rag, place on table	Salt
4. Get salt, place on table	1 cup measuring cup
5. Get chocolate sauce and milk, place on table	1/2 cup measuring cup
6. Get glasses	Dishrag
7. Open jar	Jar and top
8. Open chocolate sauce	
9. Measure 1/4 cup chocolate sauce, pour in jar	
10. Close chocolate sauce	
11. Wipe off top of chocolate sauce with rag	
12. Open milk	
13. Measure two cups of milk, pour in bowl	
14. Close milk	
15. Open salt	
16. Pour salt in hand, get one pinch of salt, put in jar	
17. Throw rest of salt in trash	
18. Close salt	
19. Close jar	
20. Shake jar vigorously	
21. Open jar	
22. Pour mixture into two glasses	
23. Pick up rag, jar, top, measuring cups; place in sink	
24. Place salt on shelf	
25. Pick up chocolate sauce, milk; place in refrigerator	
Cleaning sink	
1. Get bucket	Bucket
2. Get powdered detergent	Box of powdered cleaning detergent
3. Get sponge	Sponge
4. Take all items to sink, place on counter	Classroom sink
5. Place bucket in sink	
6. Open detergent	
7. Pour detergent into hand, empty into bucket	
8. Close detergent, place on counter	
9. Fill bucket halfway with water	
10. Remove bucket, place on counter	
11. Use sponge to mix detergent and water in bucket	
12. Wring out sponge	
13. Wipe sides of sink	
14. Place sponge in bucket, wring out	
15. Wipe bottom of sink	
16. Place sponge in bucket, wring out	
17. Wipe faucet and nobs of sink	
18. Place sponge in bucket, wring out	
19. Wipe around top of sink	
20. Place sponge in bucket, wring out, place on counter	

Table 1 continued

Skill Sequence of Responses	Materials
Cleaning sink continued	
21. Empty contents of bucket in sink	
22. Take sponge, detergent, and bucket to storage area	
23. Place detergent on shelf	
24. Place sponge on shelf	
25. Place bucket on shelf	
Folding clothes	
1. Get laundry basket, place on floor beside table	Short-sleeved shirt
2. Remove shirt from basket	Pair of pants
3. Place shirt, button side down, on table	Laundry basket
4. Turn shirt so collar is facing left side of table	Storage basket
5. Grasp and fold 1/3 of the way away from body	
6. Grasp and fold 1/3 of the way toward body	
7. Pick up collar, fold in half	
8. Pick up shirt, place in storage basket	
9. Remove pants from basket	
10. Place pants, zipper side down, on table	
11. Turn pants so waist is facing left side of table	
12. Fold pants in half so side seams placed together	
13. Pick up waist, fold in half to hem	
14. Pick up fold, fold in half to waist	
15. Pick up pants, place on shelf	
16. Pick up laundry basket, place on shelf	
Preparing envelopes	
1. Pick up letter, place on table	8 1/2 x 11" typed letter
2. Grasp bottom of letter, fold 1/3 of of the way up	Legal sized-envelope
3. Grasp top of letter, fold down	Rubber stamp
4. Pick up envelope, place flap side up on table	Ink pad
5. Hold envelope open, insert letter	Mailing labels
6. Move damp sponge over gummed area	Postage stamp
7. Seal envelope	
8. Turn envelope over	
9. Peel off mailing label, hold in two hands	
10. Place mailing label in center of envelope	
11. Pick up rubber stamp, open ink pad	
12. Place rubber stamp on ink pad, stamp return address on envelope	
13. Close ink pad, place rubber stamp on top of pad	
14. Pick up stamp, lick gummed area	
15. Place stamp on envelope	

Table 2

Number of Session, Percent of Errors, and Minutes of Direct Instructional Time Through Criterion for Each Student and Task

Task	Sessions through Criterion				Percent of Errors through Criterion				Direct Instruction Time (Minutes) Through Criterion			
	Dyad 1		Dyad 2		Dyad 1		Dyad 2		Dyad 1		Dyad 2	
Subject:	[Colin	Alma]	[Tara	Sally]	[Colin	Alma]	[Tara	Sally]	[Colin	Alma]	[Tara	Sally]
Task 1	20	23	15	15	6.1	9.2	9.2	10	185	213	99	99
Task 2	13	19	23	16	2.4	9.6	16.8	12.5	146	192	161	125
Total Across Tasks	33	42	38	31	4.3	9.4	13.5	11.3	331	405	260	224
Dyad Total Task 1	23		15		7.3		9.6		213		99	
Dyad Total Task 2	19		28		5.3		12.1		192		188	
Dyad Total Across Tasks	42		43		6.2		11.2		405		287	

Figure Captions

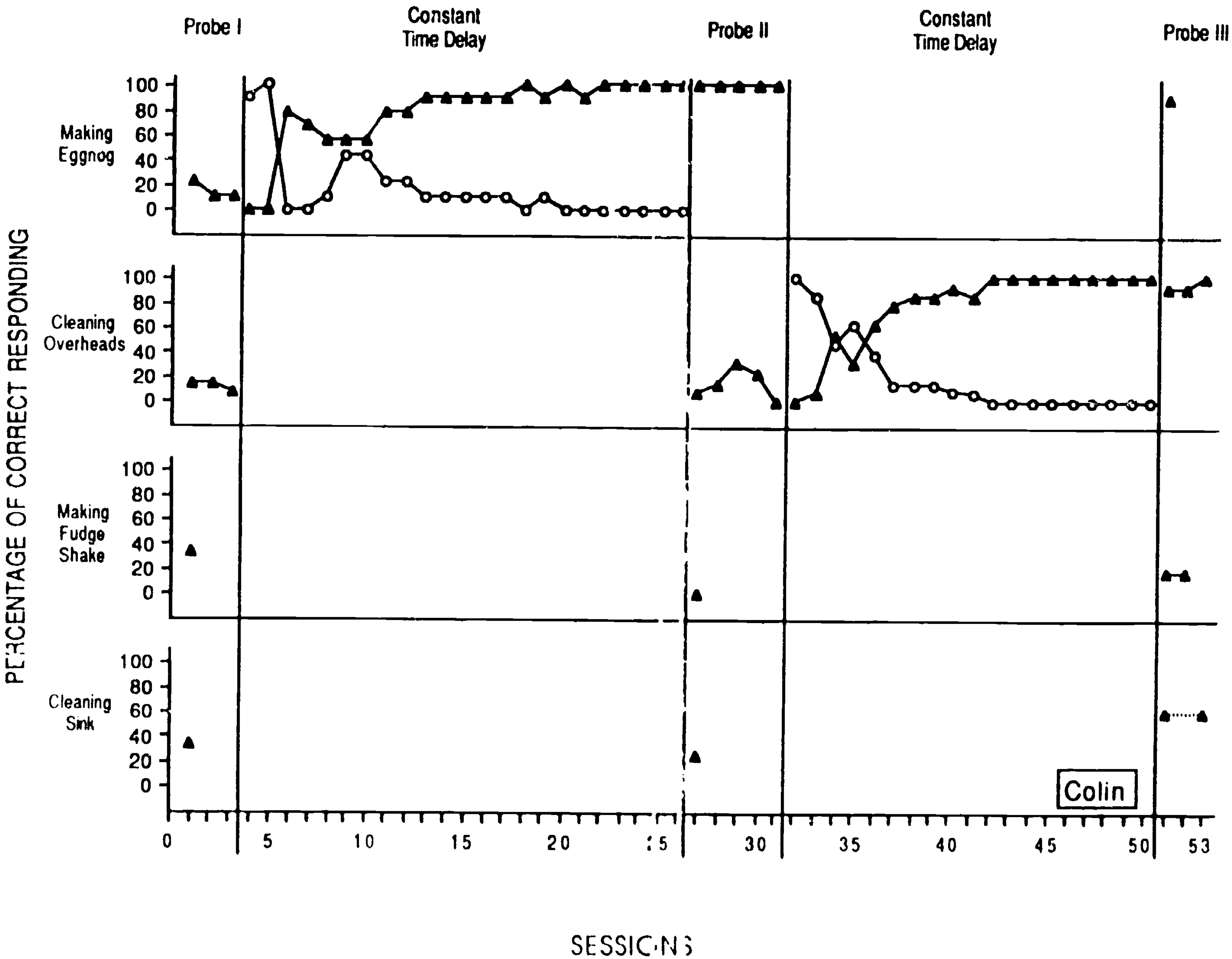
Figure 1. The percentage of correct responding on target steps in probe and training conditions across chained tasks for Colin. Sessions are labeled along the abscissa and the tasks are labeled along the ordinate. Unprompted correct responses are represented by the closed triangles and prompted correct responses are represented by the open circles.

Figure 2. The percentage of correct responding on target steps in probe and training conditions across chained tasks for Alma. Sessions are labeled along the abscissa and the tasks are labeled along the ordinate. Unprompted correct responses are represented by the closed triangles and prompted correct responses are represented by the open circles.

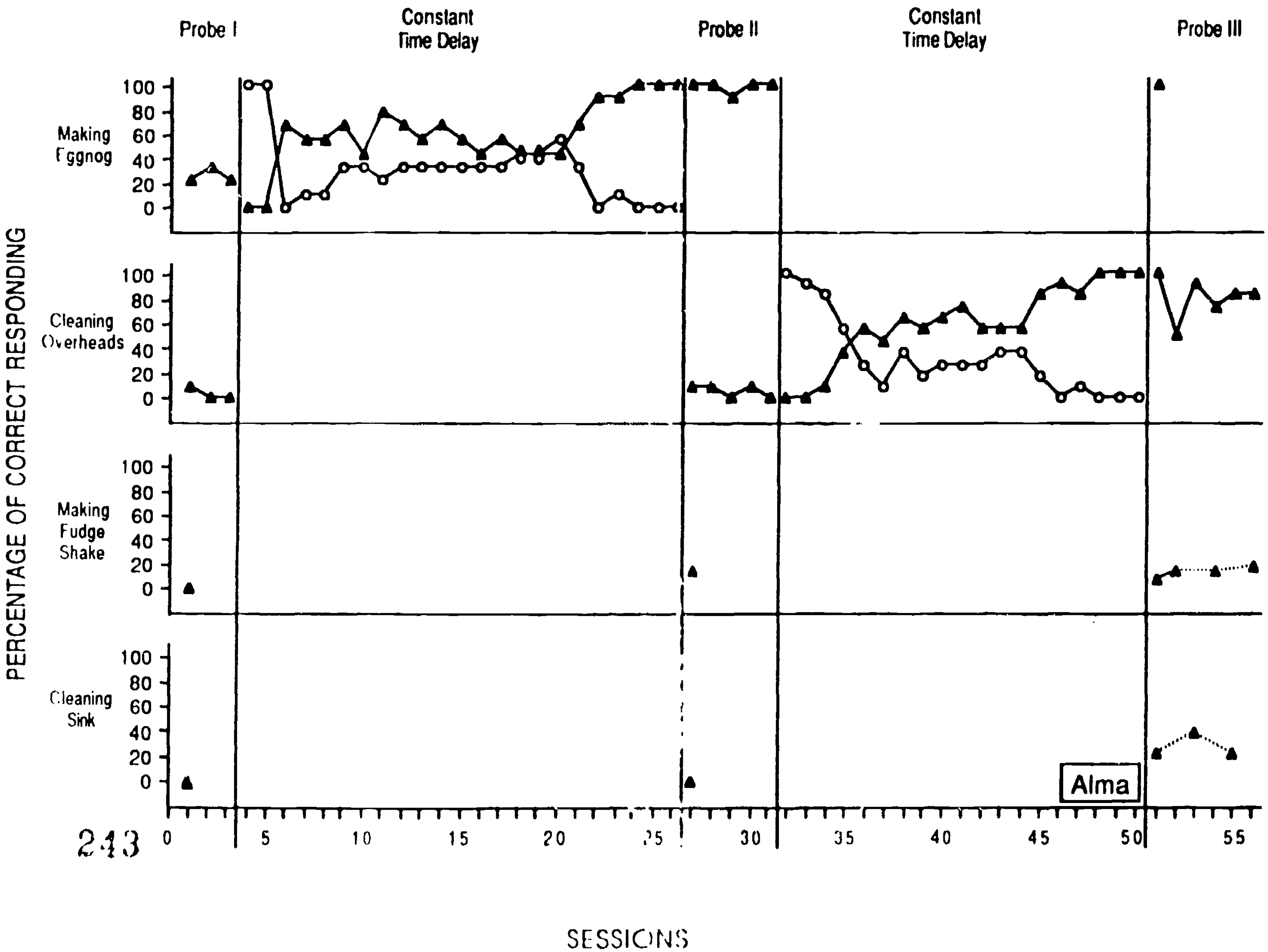
Figure 3. The percentage of correct responding on target steps in probe and training conditions across chained tasks for Tara. Sessions are labeled along the abscissa and the tasks are labeled along the ordinate. Unprompted correct responses are represented by the closed triangles and prompted correct responses are represented by the open circles.

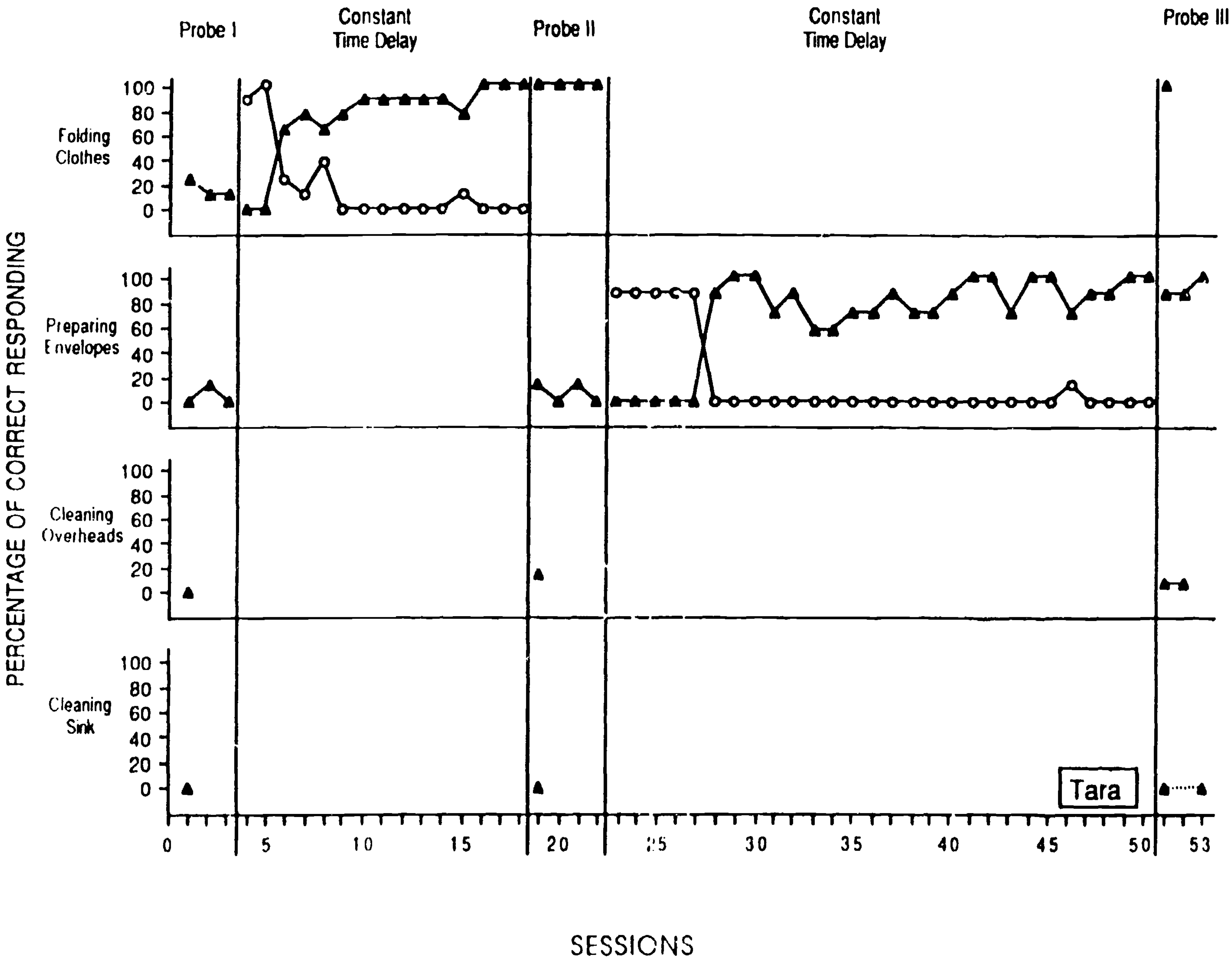
Figure 4. The percentage of correct responding on target steps in probe and training conditions across chained tasks for Sally. Sessions are labeled along the abscissa and the tasks are labeled along the ordinate. Unprompted correct responses are represented by the closed triangles and prompted correct responses are represented by the open circles.

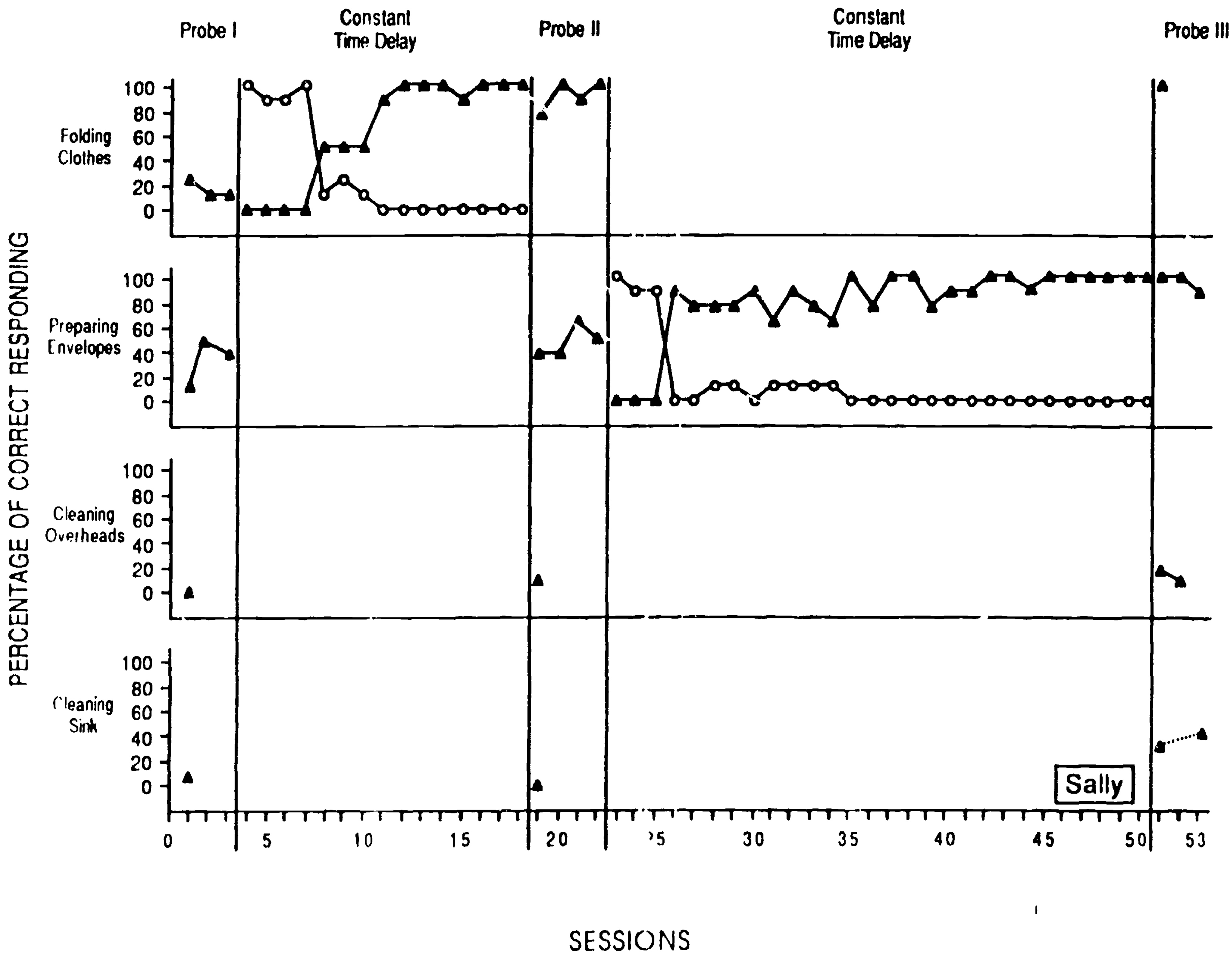
Figure 5. The mean percent of correct responses on observational steps during probe conditions conducted immediately before and after intervention.



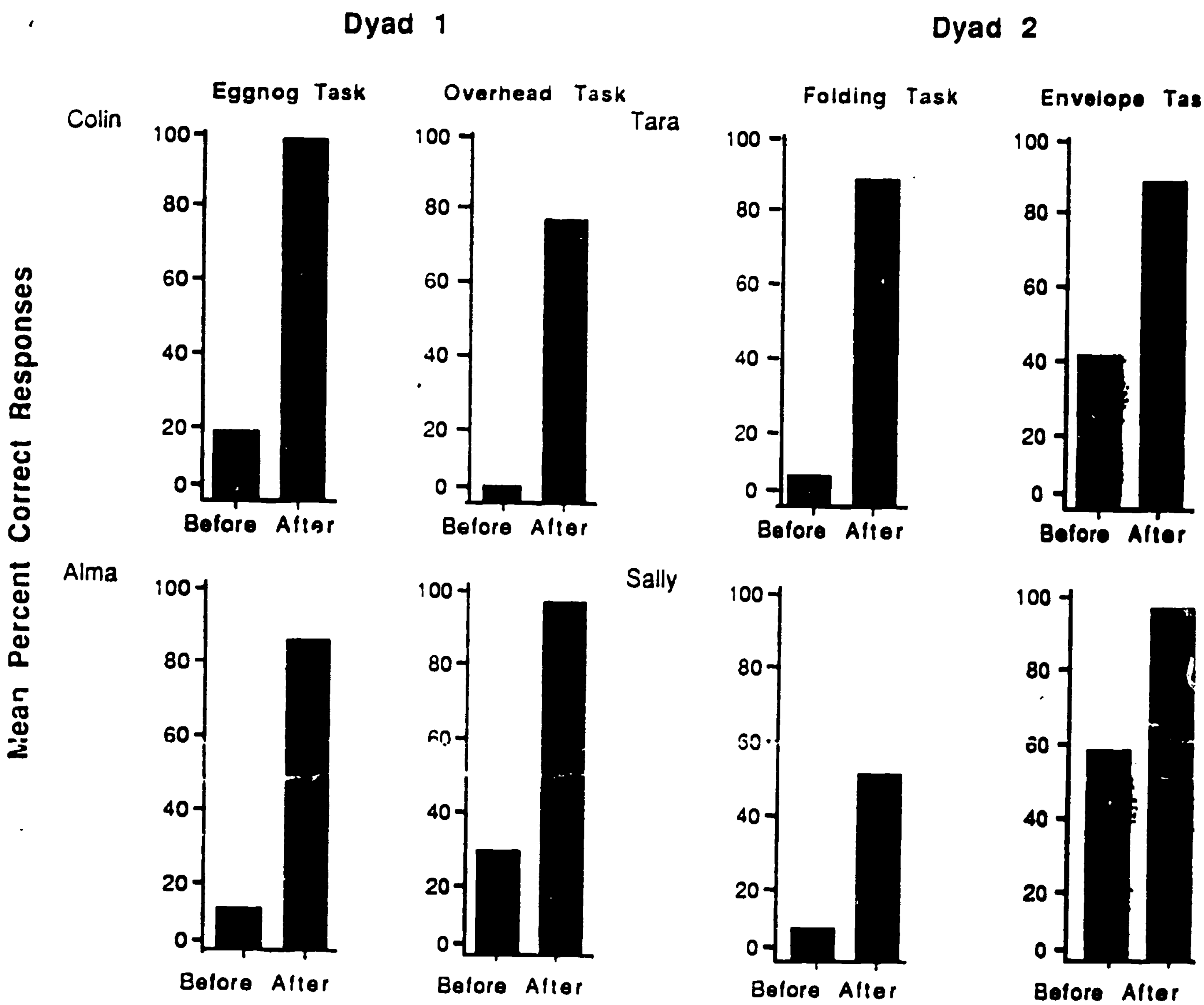
Probe I
Constant Time Delay
Probe II
Constant Time Delay
Probe III
Making Eggnog
Cleaning Overheads
Making Fudge Shake
Cleaning Sink
PERCENTAGE OF CORRECT RESPONDING
Colin
SESSIONS


Probe I
Constant Time Delay
Probe II
Constant Time Delay
Probe III
PERCENTAGE OF CORRECT RESPONDING
Making Eggnog
Cleaning Overheads
Making Fudge Shake
Cleaning Sink
100
80
60
40
20
0
Alma
0
5
10
15
20
25
30
35
40
45
50
55
SESSIONS


Probe I
Constant Time Delay
Probe II
Constant Time Delay
Probe III
Folding Clothes
Preparing Envelopes
Cleaning Overheads
Cleaning Sink
PERCENTAGE OF CORRECT RESPONDING
Tara
SESSIONS



Probe I
Constant Time Delay
Probe II
Constant Time Delay
Probe III
PERCENTAGE OF CORRECT RESPONDING
Folding Clothes
Preparing Envelopes
Cleaning Overheads
Cleaning Sink
100
80
60
40
20
0
Sally
0
5
10
15
20
25
30
35
40
45
50
53
SESSIONS


Dyad 1
Dyad 2
Eggnog Task
Overhead Task
Folding Task
Envelope Tas
Colin
Tara
Alma
Sally
Mean Percent Correct Responses
100
80
60
40
20
0
Before After

Appendix I

Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Mills, B. M. (in press). Use of choral and individual spelling attentional responses in teaching sight word reading during small group instruction. Remedial and Special Education.

Use of Choral and Individual Attentional Responses with Constant Time Delay when Teaching Sight Word Reading [1]

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Running Head: CHORAL AND INDIVIDUAL ATTENTIONAL RESPONSES

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Abstract

This study evaluated using choral and individual attentional responses with a constant time delay procedure when teaching students with mild handicaps to read sight words. Each student learned a different set of words; a choral spelling attentional response (i.e., all students simultaneously spelled the word before the target student read it) was used with half of the words, and an individual spelling attentional response (i.e., only the target student spelled the word before reading it) was used with the other half. Constant time delay was used to teach all words. Students were assessed on reading their words, reading others' words, (i.e., observational learning), and spelling all words (i.e., incidental learning). A multiple-probe design across behaviors was used to evaluate the procedures. The results indicate that (a) constant time delay was implemented reliably and was effective in teaching word reading with minimal errors, (b) words taught with an individual spelling attentional response were learned in fewer sessions and lower error percentages, (c) observational and incidental learning occurred for all students, (d) choral and individual attentional responses did not influence observational word reading, and (e) spelling was greater on others' words when a choral attentional response was used.

Use of Choral and Individual Attentional Responses with
Constant Time Delay when Teaching Sight Word Reading

The need for effective and efficient instructional procedures is widely acknowledged in the special education literature (Mercer & Mercer, 1989; Wolery, Bailey, & Sugai, 1988). As a result, a number of effective teaching practices and strategies have been developed (Borich, 1988; Wolery, Ault, & Doyle, in press). The effective teaching practices include using curriculum based assessment, managing instructional time, managing student behavior, presenting instruction clearly, monitoring student performance, adjusting instruction as necessary, and providing frequent and relevant feedback (Wolery et al., in press). Effective teaching procedures include response prompting strategies such as progressive and constant time delay (Handen & Zane, 1987), system of least prompts (Doyle, Wolery, Ault, & Gast, 1988), and most-to-least prompting (Billingsley & Romer, 1983). Stimulus modification procedures and integrated prompting strategies also have been developed (Ault, Wolery, Doyle, & Gast, 1989; Schoen, 1986).

One of these strategies, the constant time delay procedure, has recently received research attention. The constant time delay procedure involves two types of trials, 0-second trials and delay trials. The 0-second trials are presented during initial instruction and involve delivery of the target stimulus followed immediately by a response prompt (called a controlling prompt) that ensures the student will respond correctly. After use of the 0-second trials, the delay trials are presented. The delay trials involve inserting a fixed number of seconds between delivery of the target stimulus and controlling prompt. These trials remain in effect until performance reaches criterion levels.

The constant time delay procedure has been effective in teaching a variety of skills to students with a wide range of handicapping conditions. These include manual signing by secondary-aged students and adults with moderate to severe retardation (Browder, Morris, & Snell, 1981; Kleinert & Gast, 1982); numeral identification by elementary-aged students with autism (Ault, Wolery, Gast, Doyle, & Eizenstat, 1988); sight word reading by preschoolers with developmental delays (Cybriwsky, Wolery, & Gast, in press) and elementary students with moderate retardation (Gast, Ault, Wolery, Doyle, & Belanger, 1988); spelling to students with learning disabilities (Kinney, Stevens, & Schuster, 1989; Stevens & Schuster, 1987); stating factual information by junior high school students with learning and behavior disabilities (Wolery, Cybriwsky, Gast, & Boyle-Gast, in press); and community living skills such as cooking (Schuster, Gast, Wolery, Guiltinan, 1988) purchasing (McDonnell, 1987), and banking (McDonnell & Ferguson, 1989) to secondary-aged students with moderate and severe retardation. The constant delay procedure has been found to be more efficient than the system of least prompts (Doyle, Wolery, Gast, Ault, & Wiley, 1990; Gast et al., 1988; Schoen & Sivil, 1989; Wolery, Ault, Gast, Doyle, & Griffen, in press) and as efficient as progressive time delay (Ault, Gast, & Wolery, 1988).

However, the bulk of the teaching strategies literature has occurred in one-to-one rather than group instructional arrangements. Reid and Favell (1984) and Oliver and Scott (1981) suggest that group instructional arrangements are a viable alternative to one-to-one instruction. In fact, group instruction may be preferred considering factors such as demands on teacher time, generalization of skills to less restrictive settings (Fink & Sandall, 1978), appropriate interaction with peers (Alberto, Jobes, Sizemore, & Doran, 1980), and increasing the efficiency of instruction (Westling, Ferrell, & Swenson, 1982). Small group instructional sessions may enhance the efficiency of instruction because students may acquire information taught to other students in their group (i.e., observational learning) (Browder, Schoen, & Lentz, 1986). Thus, there is a need to evaluate response prompting procedures, such as constant time delay, in small group instructional arrangements.

A potential problem with group instruction is that students' attention may be difficult to maintain. Since attention to instructional materials is a prerequisite to learning, teachers need methods of ensuring that students are attending. One way to do this is to require students to emit a specific attentional response before responding to the target stimuli. For example, before providing the answer to an addition problem, they could be required to state the numerals being added; or before reading a sight word, they could be required to name the letters of the word. In small group instruction where students are each learning different behaviors, the teacher could require individual students or the group as a whole to perform the attentional response. Logically, it would seem that if all group members were required to provide an attentional response to all students' individual stimuli, then observational learning might be facilitated. This issue was evaluated in the present study. Students in a small group were each taught to read different sight words. On half of these words, all students were required to name the letters of the target word in unison (choral attentional response) before the target student read it; on the other half of the words, only the target student was required to name the letters of the target word prior to reading it (individual attentional response).

When specific attentional responses are used such as those described above, it is possible that students could incidentally learn new behaviors from them. In the present study, for example, students said the letters of the words before they read them; it was therefore possible that they could incidentally learn to spell those words as well as learn to read them. This study was not designed to study spelling directly; rather it was designed to determine whether a method for ensuring attending during sight word reading instruction would have the additional benefit of teaching spelling. Effective means of promoting spelling are important because the majority of students who have a diagnosis of learning disabilities, mild mental retardation, and behavior disorders display spelling problems (Graham & Miller, 1979).

Although spelling was investigated in this study, the procedures used should not be viewed as the primary means of spelling instruction. A complete spelling curriculum involves integrating spelling into reading, writing, and other language arts activities (Mercer & Mercer, 1989; Templeton, 1985); selecting words and word patterns for spelling that are understood by individual students and reflect the individual student's developmental progression (Templeton, 1986); addressing spelling from a conceptual perspective (e.g., application of rules) rather than a memorization approach (Graham & Miller, 1979; Templeton, 1986); assisting students in developing methods for studying new words (Graham & Miller, 1979); promoting spelling directly rather than incidentally (Graham & Miller, 1979); facilitating students' ability to identify spelling errors, proofread, and correct their own spelling (Graham & Miller, 1979; Templeton, 1986); facilitating the use of a dictionary (Graham & Miller, 1979); and establishing and maintaining students' motivation to engage in spelling activities (Graham & Miller, 1979).

The purposes of this study were (a) to evaluate the effectiveness of a constant time delay procedure in a small group using an individual criterion, and (b) to evaluate the use of a choral or individual spelling attentional response on observational and incidental learning. For the purposes of this study, observational learning was defined as acquisition of behaviors directly taught to other members of the group. Incidental learning was defined as acquisition of behaviors that were not directly taught and were not reinforced by the teacher, but to which all students were exposed to during instructional sessions (i.e., spelling of words).

Method

Participants and Setting

Four male children who were enrolled in public school participated. All children attended first grade classes and received support services in a special education resource room for students with learning disabilities, behavior disorders, and mild mental retardation. Phil, age 8 years, 1 month received a full scale IQ score of 69 on the Stanford-Binet Intelligence Scale (Terman & Merrill, 1973). He was able to identify 23 of 26 lower case letters, could read most primer level sight words, and received formal spelling instruction during his school day. Sam, age 7 years, 3 months received a full scale score of 79 on the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). He was able to identify 23 of 26 lower case letters, could not read any primer level sight words, and was able to spell only his full name and two other words. Dennis, age 7 years, 9 months, received a full scale IQ score of 81 on the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). He was able to identify 10 of 26 lower case letters, could read two primer level sight words, and was able to spell his first name only. Joel, age 7 years, 2 months, received a full scale IQ score of 70 on the Stanford-Binet Intelligence Scale (Terman & Merrill, 1973). He was able to identify 24 of 26 lower case letters, could read three primer level sight words, and could spell his first name.

Prerequisite skills exhibited by all students included: (a) intact vision and hearing, (b) remain on-task in a small group setting for 10 minutes, (c) wait 4 sec for a prompt from the teacher, (d) imitate the teacher's verbal models, (e) respond correctly to "What word?" when shown known words, and (f) select a reinforcer from an array.

Sessions were conducted by the resource room teacher (fifth author) in her 4.7 x 5.4m classroom at a kidney-shaped table. The teacher was seated on one side of the table and opposite the children so that they could see and hear the instructions; students sat in the same seat each day.

Materials

Primer and first grade level target words were selected from the Dolch Basic Word List (Dolch, 1936) and were hand printed in lower case letters in black ink on white cards (7.6 x 12.7 cm). Pennies were used as tokens, and each student used a cup as a container for their tokens. A plastic box contained a variety of back-up reinforcers (e.g., stickers, candy, charms, toys, etc.). Tokens were used in probe and instructional sessions.

Procedures

General Procedures. One small group instructional session occurred each school day if at least 2 students were present. A constant time delay procedure was used to teach target words. Two sets of words were targeted to be taught to each student; one set to be taught using a choral spelling attentional response, and the other taught using an individual spelling attentional response. During instructional sessions, each student learned two words which were randomly intermixed; one taught with a choral attentional response and the other taught with an individual attentional response. Each word received five trials for a total of ten trials per student. The words were randomly intermixed for presentation with no word presented on more than three consecutive trials. Students were assessed for observational learning on other students' target words. The words taught to each student and the type of attentional cue used are shown in Table 1 and 2.

Probe procedures. To assess a student's ability to read his target words, probe sessions were conducted in the small group arrangement. For each student, a probe condition consisted of at least four probe sessions of ten trials each, or until stable performance was evident. During probe conditions, at least five trials on each of the eight words were presented across the four sessions. Probe conditions were conducted prior to receiving instruction on any words, and the day after criterion was met on each successive word pair. A total of eight words was always presented during probe conditions. For each student, beginning with Probe III and continuing on each successive probe, two new words replaced the two words that had been previously taught and had been measured in previous probe conditions. This ensured that probe measures were obtained on a continuous pool of new words to be taught.

For each probe trial, the teacher held up the word card, said "Everybody look.", ensured that the target student looked at the card, said, "(Target student), What word?", waited 4 sec for a response, and recorded the response during a 2-5 sec intertrial interval. No reinforcement for correct or incorrect responses was given during probe sessions, but students received verbal praise and a token on the average of every third trial (i.e., VR3 reinforcement schedule) for appropriate attending behaviors such as looking at the cards or sitting appropriately in their chairs. No spelling attentional responses were used during probe sessions. Responses were scored as (a) correct - student said the word within 4 sec of "What word?"; (b) incorrect - student said any word other than the correct one within 4 sec of "What word?";

and (c) no response - student did not say any word within 4 sec of "What word?". Students exchanged tokens for back-up reinforcers at the end of each probe session.

Choral and individual spelling attentional responses. On instructional trials receiving a choral spelling attentional response, the teacher held up the target word, said "Everybody look" and then said, "Everybody spell this word.". The teacher then pointed to and named each letter in the word while ensuring that all students in the group named the letters in unison within 1 sec after each letter model. On trials using an individual spelling attentional response, the teacher said, "Everybody look" and then said, "(Target student), spell this word.". The teacher then pointed to and named each letter in the word while ensuring that only the student who was assigned this target word named the letters aloud within 1 sec after each letter model.

Constant time delay. Each time delay instructional session included ten trials per student; five trials on a word using the choral spelling attentional response and five trials on a word using the individual spelling attentional response. In the first instructional session for each pair of words, the teacher presented the trials using a 0-sec delay interval between the task direction (i.e., "What word?") and controlling prompt (i.e., verbal model of the word). That is, after presenting the task direction, the teacher immediately stated the correct word. In all subsequent sessions, the teacher presented the task direction and then waited 4 sec before delivering the controlling prompt (4-sec delay interval). A criterion of 100% correct prompted responses at the 0-sec delay interval was required before a 4-sec delay was implemented.

During instructional trials, the teacher held up the word card, said "Everybody look," ensured the target student looked at the word card, gave the appropriate spelling attentional cue, and said "(Target student), What word?". If the student did not respond within the 4-sec delay interval, then the instructor delivered the controlling prompt and waited 4 sec for a response. During instruction, five potential responses were scored. Unprompted correct responses occurred when the student stated the word correctly before the teacher's model; a prompted correct response occurred when the student correctly imitated the teacher's model within 4 sec; unprompted errors occurred when the student said any word other than the correct word before the teacher's model; prompted errors occurred when the student said any word other than the correct word within 4 sec after the teacher's model; and no response errors were scored when the student did not say any word within 4 sec after the model. Only the first response after the task direction was scored, (i.e., students were not allowed to self-correct).

Unprompted and prompted correct responses resulted in the teacher saying "Good," repeating the word, delivering one token to the student, and initiating the intertrial interval. Only unprompted corrects were counted toward criterion performance. Unprompted errors resulted in the teacher saying "Wait if you don't know", repeating the model, and initiating the intertrial interval. Prompted and no response errors resulted in the teacher repeating the model, and initiating the intertrial interval. If students earned 8 out of 10 possible tokens (pennies), they exchanged them for a back-up reinforcer, or if less than eight, kept the tokens at the end of the session. Criterion for mastery of each word pair was 100% unprompted correct responses for one session when reinforced on a continuous reinforcement schedule (CRF) and two consecutive sessions of 100% unprompted correct responses when reinforced on a VR3 reinforcement schedule. Once a student met criterion, probe trials were conducted on the following day regardless of the performance of the other group members. Therefore, it was possible for some students in the group to be receiving instructional trials and other group members to be receiving probe trials during the same session. This allowed students to progress at their own pace without being delayed by slower group members.

Review trials. At the beginning of each instructional session, two review trials on previously learned target words were delivered to each student for maintenance purposes. During instruction on the first word pair, review trials were conducted on words that students knew prior to implementation of the investigation. Beginning with instruction on the second word pair however, review trials were conducted on words learned previously during the investigation. The teacher held up a word card, said, "Everybody look," and "(Target student), What word?". Verbal praise, a repeat of the model, and a token were delivered for each correct response. For incorrect responses, the teacher said, "No, this word is ______.". No spelling attentional responses were used during review trials.

Measurement of observational learning. During instruction, students in the group had the opportunity to observe words being directly taught to other group members. Their ability to read words taught to other students was measured at three different times. First, following the initial probe condition, all students were pretested on their ability to read the first 8 words scheduled to be taught to each of the other group members. Second, when a student of the group met criterion on a word pair, all other group members were given a posttraining test on the two words just learned by that student and a pretraining test on the two words to be learned next by that student. And third, after the final probe condition, all students were posttested on all of the words taught to each of the other group members during the course of the investigation. All observational learning assessments were conducted in one-to-one arrangements by the teacher at another time of the day than the group session. The teacher presented the word card, said, "What word?", and waited 4 sec for a response. For both correct and incorrect responses, the teacher removed the word card and initiated the intertrial interval, (i.e., there was no teacher feedback on observational learning words). Verbal praise for appropriate attending behaviors was delivered on a VR3 reinforcement schedule.

Measurement of incidental learning. During instruction, students were exposed to information that was not directly taught (i.e., spelling of the words during attentional cues/responses). Students were assessed on their ability to spell words in a variety of ways including (a) receptive identification of correct spellings, (b) written spelling, and (c) oral spelling. Prior to all instruction, students were assessed on their ability to choose a correct spelling from a choice of eight spellings, and to correctly print the first 8 target words to be taught during the study. Posttests were also conducted on these measures following the final probe condition. Students' ability to orally spell their target words and words taught to other members of the group was assessed at the same times in the study as observational learning words. The research associate conducted all incidental learning assessments exactly as observational learning sessions in one-to-one settings.

Experimental Design

A multiple probe design across word pairs and replicated with 4 students was used to evaluate experimental control (Horner & Baer, 1978; Tawney & Gast, 1984). Experimental control was demonstrated when student responding on targeted words increased only following constant time delay instruction and ''d not increase on untrained words prior to intervention. The words taught to e.ch student were placed in pairs of equal difficulty so that differences in difficulty between the two sets of words were minimized. One member of each pair was then randomly assigned to the two spelling conditions. Words from both conditions were equal in that they were of the same grade level and they had the same number of letters.

Experimental conditions were implemented in the following sequence: (a) individual pretests conducted on receptive spelling, written spelling, and oral spelling of target and observational words; individual pretests conducted on observational words; probe trials conducted on reading of target words in the group session; (b) two words were taught to each student using a constant time delay procedure until individual criterion was met; (c) individual pre- and posttraining tests conducted on other group members' ability to read the words of the student who had just met criterion and the words that would be taught next; individual pre- and posttraining tests conducted on the target and other group members' ability to spell the target student's words just taught and those to be taught. This sequence was repeated until all targeted words had been acquired. At the completion of training, individual posttests were conducted on all observational words taught during the investigation and on receptive spelling, written spelling, and oral spelling of all words.

<u>Reliability</u>

Reliability assessments on student responding and procedural fidelity (Billingsley, White, & Munson, 1980) were conducted at least once each week and/or at least once during each experimental condition by a research associate (second author). A point-by-point method (the number of agreements divided by the number of agreements plus disagreements multiplied by 100) was used to calculate interobserver agreement percentages. For procedural reliability, the following behaviors were measured: presenting the correct word, giving the general attentional cue "Everybody look", giving the correct choral or individual spelling attentional cue (instructional condition only), ensuring an attentional response, giving the task direction "What word?", waiting the correct response interval, providing the prompt when appropriate, providing the correct consequences, and waiting the intertrial interval. Procedural fidelity percentages were calculated by dividing the number of actual teacher behaviors by the number of planned behaviors and multiplying by 100.

Results

Reliability Results

Reliability assessments were conducted during 43% of the probe sessions and 43% of constant time delay sessions. The mean percent agreement on student responding during probe sessions was 98, 99.3, 99, and 99.2 for Phil, Sam, Dennis, and Joel respectively. Thus, for 535 probe trials on which agreement was assessed, 7 disagreements occurred. During group instruction, student responding reliability was 99.3, 100, 100, and 99.4 for Phil, Sam, Dennis, and Joel, respectively. Thus, for 668 instructional trials on which agreement was calculated, 2 disagreements occurred. Procedural reliability during probe sessions was 100% for the behaviors of presenting the word, giving the general attentional cue, ensuring the student's response, and saying "What word?". Those behaviors less than 100% included: 99.1% (range 90-100%) for waiting the response interval, 99.8% (range 96.6-100%) for providing the correct consequences, and 99.6% (range 90-100%) for waiting the intertrial interval. During group instruction, reliability was 100% for the behaviors of presenting the word, giving the general attentional cue, giving the correct spelling attentional cue, saying "What word?," and waiting the intertrial interval. Reliability estimates were 98.9% (range 90-100%) for ensuring student's attentional response, 98.6% (range 90-100%) for waiting the response interval and providing a prompt, and 97.6% (range 84.2-100%) for providing the correct consequences.

Acquisition of Target Words

The mean percent of correct responses for Phil and Sam during probe conditions are shown in Table 1 and for Dennis and Joel in Table 2. For all students, the mean percent of correct responding on target words was 10% or less in the probe condition immediately prior to instruction. With the introduction of the constant time delay procedure, all students met criterion on all words. Since students learned new words based on an individual criterion, they each learned a different number of words. Phil learned 8, Sam learned 14, Dennis learned 6, and Joel learned 10 words in 37, 35, 39, and 45 sessions respectively. Thus, the time delay procedure with the use of individual and choral attentional responses was effective in teaching target sight word reading to this group of students.

For 2 students, modifications of the procedure as written were necessary for students to reach criterion. On word pair 1 for Dennis and word pairs 1 and 3 for Joel, a differential reinforcement procedure was implemented which involved requiring students to earn 100% correct unprompted responses rather than 80% correct unprompted responses during a session before they were allowed to choose a back-up reinforcer. This was implemented because both students were providing high percentages of prompted correct responses but not unprompted correct responses. Retraining of the same word pair occurred immediately following probe conditions for Phil on word pair 2, and Dennis on word pairs 3 and 4, because their performance on those word pairs did not maintain on the probe trials that occurred at the end of the probe condition.

No other procedural modifications were made during the investigation. On one word pair for Phil and Dennis and two pairs for Sam, students were able to read words before intervention occurred on those words. When this occurred, those pairs were not taught, and pairs with 0% correct responses during probes were taught instead.

Insert Tables 1 and 2 about here

Efficiency of Instruction

The total number of probe and instructional sessions in which students participated ranged from 73 to 79. The average session length was 7 min 6 sec, with a range of 1 min 50 sec to 11 min 17 seconds. Efficiency data in terms of the mean number of sessions and the mean percent of errors _to_ and _through_ criterion per word pair for words taught with choral and individual spelling attentional responses and for all words combined are presented in Table 3. Data on sessions and errors _to_ criterion were based on the first instructional session until the choral or individual word met the CRF criterion. Data for all words combined were based on the first instructional session until both words simultaneously met the CRF criterion. Data for sessions and errors _through_ criterion were based on the first instructional session until the choral or individual word met the VR3 criterion, and for both words combined was based on when the choral and individual word simultaneously met the VR3 criterion. Across all the words learned by all students, the average number of sessions to criterion per word pair was 4.79 (range 2.57-6.0), and through criterion was 8.16 (range 4.86-13.0). All students learned their target words with a low mean percent of error to criterion (mean = 0.17%, range .07%-1.53%) and through criterion (mean = 0.13%, range = 0.62-1.0%).

In comparing the efficiency measures based on the mean number and percent of choral versus individual words, the words taught with an individual spelling attentional response were taught in a fewer number of sessions and with a lower percentage of errors on 15 out of 16 comparisons (4 students times 4 efficiency measures). While differences between the two conditions were not large, they were consistent across subjects. For individual students, differences between the choral and individual words ranged from an average of 0.5-2 sessions to criterion, 0.12-0.86% errors to criterion, 0.25-1 session through criterion, and 0.06-1% errors through criterion. In the one exception to these results, choral words required an average of 0.39 fewer sessions through criterion than individual words for Sam.

Insert Table 3 about here

Observational and Incidental Learning

The percent of net gain on observational words and incidental spelling that students learned during group instruction are presented in Table 4. Data on observational word reading was based on pretraining assessments which occurred immediately before instruction on a word pair and posttraining assessments that occurred immediately after criterion was met on a word pair. Since students progressed at their own pace, each student was exposed to a different number of observational words. Phil was exposed to 30, Sam to 24, Dennis to 32, and Stephen to 28 observational words. All students learned some words taught to other students. Phil, Sam, Dennis, and Joel learned to read a net gain of 10, 14, 4, and 14 observational words respectively (mean percent net gain 37%, range 13-59%). When comparing percent net gain of choral versus individual observational words, mixed results were found. Phil was able to read more words that were taught chorally, Sam and Joel read more words taught individually, and Dennis read the same percent of words regardless of condition. Overall, no consistent differences in observational word reading across students between choral and individual words were found.

Insert Table 4 about here

In terms of incidental learning, all 4 students learned to orally spell some words, 3 of the 4 students learned to write some words, and all 4 students learned to receptively identify some correct spellings by exposure to material that was not directly taught during group instruction. Students' ability to orally spell words was based on pretraining and posttraining assessments as described for observational learning measures. Students' ability to write and receptively identify the words was measured prior to training on the words and after criterion was met on all words in the investigation. Across all measures, students were able to orally spell, write, and receptively identify more of their target than observational words.

When comparing target words taught with a choral versus an individual attentional response, no consistent differences were found across students on any of the incidental measures. In addition, no consistent differences across students were found between choral and individual observational words in terms of their ability to write or to receptively identify correct spellings. However, in terms of students' ability to orally spell observational words, all students were able to spell more words that were taught with a choral spelling attentional response than with an individual one. Overall comparisons between choral and individual words on all spelling measures indicated that on the 12 measures (4 students times 3 measures) on target words, 2 out of 12 comparisons favored choral words, 5 out of 12 comparisons favored individual words, and 5 comparisons showed no differences between conditions. On 8 out of 12 comparisons on observational words, more information was learned with choral words. 2 out of 12 comparisons had more information learned with individual words, and 2 comparisons showed no differences between conditions.

Discussion

The purpose of this study was (a) to evaluate the effectiveness of a constant time delay procedure on sight word acquisition in a small group using an individual criterion, and (b) to compare the use of a choral and individual spelling attentional response on observational and incidental learning when constant time delay was being used. Students were measured on whether they learned to read their target words, words taught to other students, and learned to spell their words and those taught to other students.

The constant time delay procedure was effective in teaching sight word reading to all group members. Students' responding levels increased when intervention was introduced and remained low prior to the introduction of the delay procedure on 27 out of 31 pairs. On four pairs however, 3 students were able to identify words that had not been taught. On these words, students may have been exposed to the words during their ongoing classroom instruction which occurred both in the resource room and mainstreamed classrooms. These students could also identify some consonant sounds which may have contributed to their learning untrained words. No student performed above 67% on these four pairs.

The use of the individual criterion enabled students to learn words based only on their performance, regardless of the performance of the other group members. Because of this criterion, members of the group learned at their own pace, thus, some members were able to learn more words than if a group criterion had been used. One factor that must be considered when using an individual criterion is procedural fidelity since more than one condition may occur during a single group session. In this investigation, a classroom teacher successfully implemented the procedures with high procedural reliability (mean on each teacher behavior was above 97% correct implementation) although in 74.6% of the group sessions, at least two instructional phases and/or conditions were being implemented during the same session. This supports previous research that the constant time delay procedure can be reliably implemented in one-to-one instructional settings (Ault, Gast, & Wolery, 1988; Stevens & Schuster, 1987) and extends these findings to the reliable implementation of the procedure in a small group arrangement with students with mild handicaps. The teacher in the current study held a Bachelor's degree in Special Education with certification in Elementary Education and Learning and Behavior Disorders, had completed a planned fifth year of graduate work in Special Education, and had 4 years of teaching experience with students who have mild handicaps.

The effects of the two attentional responses (individual and choral) were evaluated on students learning their target words, observational learning (learning other students' words), and incidental learning (learning to spell the words). The efficiency data indicated that all group members learned all targeted sight words with a low percent of errors regardless of the type of attentional response used. These data are similar to other time delay research in which error percentages are low (Kleinert & Gast, 1982; Stevens &

Schuster, 1987). However, a small but consistent difference existed between choral and individual attentional responses. Words taught with an individual spelling attentional response were learned in fewer sessions and with a lower percent of error. This may have occurred because students were able to discriminate individual trials as their target trial more easily than choral trials, thus increasing their attention to the stimulus. Individual trials always began with only the target student making the spelling attentional response. Choral trials began with all students performing the attentional response for their words and for other students' words. It is also possible that other students' voices during the attentional response in some way interfered with the target student's attention to the trial; this, of course, would not occur when only the target student was responsible for making an attentional response.

Observational learning occurred for all group members. Overall, students had a mean percent net gain of 37% of all observational words (range 13-59%). Although observational learning occurred, it did not reach high levels. The use of an individual criterion may have prohibited extensive observational learning. Since students received new words immediately following mastery, an opportunity for students to learn observational words through over-learning trials or additional exposures was not possible. In addition, students were not told they would be tested on observational words and were not reinforced for correct responses during observational assessments. Future research should address the effects of a group versus an individual criterion on observational learning and reinforced versus nonreinforced assessments of observational learning. Observational learning did not appear to be affected by the type of attentional response used.

Incidental learning also occurred to some degree for all members of the group and across all measures; it was, however less than observational learning (mean net gain 26%, range 7-49%). Phil, the only student who received formal spelling instruction during another time of the day, learned to orally spell at least twice as many words as the other group members. More incidental learning may have occurred if the other students were more familiar with spelling. This suggests that teachers should carefully choose incidental information to place in the trial sequence and researchers should examine the effects of familiarity of content when it is presented as incidental information. On the three incidental spelling measures, for the most part, students learned more information related to their target words than to observational words which may indicate again that target words received more attention than observational words from the students. On these measures, differences between choral and individual words occurred only on information learned on observational words. On these words, students on 8 out of 12 comparisons learned more spelling information when observational words were taught with a choral attentional response. Thus, at least for observational words, the choral response may enhance incidental learning.

Implications of this investigation for classroom teachers indicate that the constant time delay procedure can be used effectively in a small group arrangement with students with mild handicaps where the criterion for moving to new behaviors is based on individual performance. Students will learn both observational and incidental information when taught in groups. An experienced teacher was able to reliably implement the procedures when an individual criterion was used which involved providing more than one instructional condition per session to different students. This individual criterion enabled students to progress at their own pace through instruction and all students successfully learned using the time delay procedure. In addition, the data indicated that students may learn slightly more efficiently when an individual spelling attentional response is used. However, the data also indicate that at least on observational words, incidental learning may be enhanced when a choral attending response is used. Additional research should address the combined effects of varied attentional responses with effectiveness and efficiency to determine the best possible combination to produce the most learning in students.

This study, as with others in the literature, has certain limitations. Some of these limitations are related to the students, type of content, and the teacher implementing the procedures. Four early-elementary-aged students with learning handicaps were studied in this investigation. Further research is needed to determine whether these findings would occur with more students, in larger groups of students, with students of an older age, and with students who had different handicapping conditions. However, based on the arguments of Birnbrauer (1981), the results are most likely to generalize to students who have similar entry level behaviors; that is, students who had intact vision and hearing; could stay on-task in a small group setting for 10 minutes; would wait 4 sec for a prompt from the teacher; would imitate the teacher's verbal models; would respond correctly to "What word?" when shown known words; and would select a reinforcer from an array. The behaviors taught in this study were Dolch sight words; it is unclear whether other behaviors would be learned with similar results. Also, the teacher in this study, as described above, was well trained and experienced. The use of these procedures with less experienced teachers may result in different findings. Further, in the present study the procedures were implemented with a high degree of fidelity. It is not clear what learning would occur if the procedures were implemented with much less precision. This is an area which deserves considerable research attention before firm recommendations about the use of the response prompting procedures in usual special education classrooms can be made with confidence.

Two other limitations deserve note. First, in this study, token reinforcement was provided during probe conditions for attending to probe trials and was made contingent upon correct performance during training. Thus, these results are limited to situations where token reinforcement is available in a similar manner. Second, in this study the two attentional responses were implemented within the same session. It is unclear what effects would have occurred if the two attentional responses had been used in separate sessions or if only one attentional response had been used. These are clearly issues for further research.

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Table 1.

Mean Percent of Correct Responses During Probe Conditions for Phil and Sam [a]

Student	Word Pair	Attentional Cue [b]	Words Taught	Probe I	Probe II	Probe III	Probe IV	Probe V	Probe VI	Probe VII	Final Probe
Phil	1	C	may	0	100						75
		I	saw								
	2	C	could	0	0	100					100
		I	laugh								
	3	C	start	0	0	0	71	100			100
		I	going								
	4	C	please	0	10	20	0	10	71	80	83
		I	pretty								
	5	-	grow			10	42	40	42	0	0
		-	over								
	6	-	about				0	0	0	0	0
		-	every								
	7	-	work						0	0	0
		-	sing								

Student	Word Pair	Attentional Cue [b]	Words Taught	Probe I	Probe II	Probe III	Probe IV	Probe V	Probe VI	Probe VII	Probe VIII	Final Probe
Sam	1	C	fly	0	100							100
		I	ate									
	2	C	walk	0	0	90						100
		I	very									
	3	C	want	0	10	0	90					75
		I	open									
	4	C	hurt			0	0	90				100
		I	them									
	5	C	far				0	0	100			75
		I	how									
	6	C	always					0	0	100		100
		I	before									
	7	C	round						0	0	100	100
		I	thank									
	8	-	your							30	60	50
		-	cold									
	9	-	they								0	0
		-	were									
	10	-	down	10	41	20	40	40	20	40	60	25
		-	live									

[a] Vertical and horizontal lines indicate [illegible]

Table 2.

Mean Percent of Correct Responses During Probe Conditions for Dennis and Joel [a]

Student	Word Pair	Attentional Cue [b]	Words Taught	Probe I	Probe II	Probe III	Probe IV	Probe V	Final Probe
Dennis	1	C	this	0	100				50
		I	here						
	2	C	out	0	0	69	70		83
		I	new						
	3	C	gave	0	0	0	0	89	50
		I	wish						
	4	-	warm			0	0	0	67
		-	upon						
	5	-	soon					0	0
		-	same						
	6	-	by	0	0	0	40	50	0
		-	on						

Student	Word Pair	Attentional Cue [b]	Words Taught	Probe I	Probe II	Probe III	Probe IV	Probe V	Probe VI	Final Probe
Joel	1	C	what	0	71					100
		I	came							
	2	C	her	0	0	90				83
		I	old							
	3	C	like	0	0	0	80			83
		I	then							
	4	C	just	0	0	0	0	100		100
		I	ride							
	5	C	much			0	0	0	78	83
		I	show							
	6	-	carry				0	0	0	0
		-	where							
	7	-	who					0	0	0
		-	put							
	8	-	ask						0	0
		-	why							

[a] Vertical and horizontal lines indicate where training occurred.
[b] "C" = choral and "I" = individual attentional cues during instruction.

Table 3.

Efficiency Data To and Through Criterion by Attentional Response and Student

Student	Attentional Response	Efficiency Measure: Mean Number Sessions TO Criterion	Mean Percent Errors TO Criterion	Mean Number Sessions THROUGH Criterion	Mean Percent Errors THROUGH Criterion
Phil	Choral	4.75	1.3	9.25	0.93
	Individual	4.25	1.18	9.0	0.55
	All words	6.0	1.03	9.25	0.73
Sam	Choral	2.43	0.16	4.47	0.89
	Individual	2.29	0.0	4.86	0.83
	All words	2.57	0.07	4.86	0.83
Dennis	Choral	6.67	1.33	12.67	1.57
	Individual	4.67	0.47	11.67	0.57
	All words	8.67	1.53	13.0	1.0
Joel	Choral	4.0	0.8	8.0	0.9
	Individual	3.0	0.52	7.4	0.32
	All words	4.6	0.6	9.0	0.62
Across All Students	Choral	4.0	0.19	7.74	0.18
	Individual	3.26	0.12	7.47	0.08
	All words	4.79	0.17	8.16	0.13

Table 4.

Percent of Net Gain on Observational and Incidental Measures from Pretest to Posttest

Student	Attentional Response	Measure [a]						
		Observational Word Reading	Oral Spelling		Written Spelling		Receptive Spelling	
			Target [b]	Observe [c]	Target	Observe	Target	Observe
Phil	Choral	46	75	73	25	26	70	27
	Individual	20	75	60	50	7	50	42
	All words	34	75	67	38	17	60	34
Sam	Choral	42	29	25	29	25	24	33
	Individual	75	43	17	29	17	27	28
	All words	59	36	21	29	21	25	29
Dennis	Choral	13	0	6	0	0	20	0
	Individual	13	33	0	0	0	25	-1
	All words	13	17	3	0	0	20	-1
Joel	Choral	29	20	7	0	0	72	46
	Individual	57	20	0	0	7	72	21
	All words	42	20	4	0	4	54	34
Mean Percent Across Students	Choral	32	31	28	14	13	47	27
	Individual	41	43	19	20	8	36	23
	All words	37	37	24	17	11	40	24

[a] Observational word reading and oral spelling data represent pre- and post-training assessments. Written and receptive spelling data represent pre- and posttest assessments.

[b] Target = target words

[c] Observe = observational words

Appendix J

Wolery, M., Cybriwsky, C., Gast, D. L., & Boyle-Gast, K. (in press). General and specific attentional responses: Acquisition and maintenance of target, observational, and related nontarget facts. Exceptional Children.

General and Specific Attentional Responses: Acquisition and Maintenance of Target, Observational, and Incidental Behaviors[1]

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Running Head: ATTENTIONAL RESPONSES

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Abstract

This study investigated the effects of constant time delay (an errorless learning procedure) in small-group instruction with adolescents who have learning or behavior disorders. Two attentional responses (specific and general) were used, and two types of praise were employed, one which included additional task information and one that only provided general praise. Students were taught four sets of information and each of the attentional responses and praise forms were present in each set. Measures were taken on students' performance on target behaviors, observational behaviors (target behaviors for other group members), incidental learning (information provided in descriptive praise statement), and observational-incidental learning (information provided in praise statements for other group members). The results indicate that (a) constant time delay was reliably implemented and was effective in establishing criterion level performance, (b) students acquired targeted behaviors with minimal errors, (c) students acquired some behaviors targeted for other students, (d) students acquired some information presented in praise statements for their target behaviors, (e) students acquired some information presented in praise statements for other group members, (f) specific attentional responses facilitated maintenance of observational learning, and (g) specific attentional responses facilitated acquisition of incidental information.

General and Specific Attentional Responses: Acquisition and Maintenance of Target, Observational, and Incidental Behaviors

Effective instructional strategies for teaching students with handicaps include constant and progressive time delay (Handen & Zane, 1987), the system of least prompts or increasing assistance (Doyle, Wolery, Ault, & Gast, 1988), most-to-least prompting (Billingsley & Romer, 1983), and integrated prompting procedures and stimulus shaping and fading (Ault, Wolery, Doyle, & Gast, in press; Schoen, 1986). When selecting from these procedures, teachers should choose the least intrusive, least restrictive, most parsimonious, most effective, and most efficient strategy. Although intrusiveness, restrictiveness, and parsimony frequently are assessed through logical analyses, the effectiveness and efficiency of procedures are evaluated through research. Effectiveness deals with whether students learn what is taught, and efficiency focuses on the relative speed of learning.

Traditionally, efficiency has been measured by calculating the number of sessions, trials, and errors; the percent of errors; and the number of minutes of direct instruction to criterion. A procedure is more efficient than another when it requires fewer sessions, trials, errors, or minutes of instructional time to teach the same behaviors. Efficiency also can be measured by whether multiple behaviors are learned with the same amount of instruction. If two strategies produced the same number of trials to criterion, but one strategy resulted in the student also learning another adaptive behavior, then the second would be considered more efficient.

Group, as compared to 1:1, instructional arrangements, are recommended to increase the efficiency of instruction both in terms of teacher time and the opportunity to learn additional behaviors through observation (Westling, Ferrell, & Swenson, 1982). Although group instruction has been used with students having mild to moderate handicaps (Alig, Wolery, & Gast, 1988), severe and profound handicaps (Faw, Reid, Schepis, Fitzgerald, & Welty, 1981), and combinations of handicapping conditions (Orelove, 1982), additional research needs to identify factors that will increase observational learning. One such variable is students' attention to stimuli taught to other group members. Ideally, students should attend to the critical features of stimuli presented to others (Bandura, 1971). Thus, the cues teachers use to secure and maintain students' attention, and the responses students use to indicate that they are attending may be critical variables to manipulate when increasing observational learning (LeBlanc & Ruggles, 1982).

Another variable that may increase the probability of learning multiple behaviors is the event that follows student responding. Teachers frequently are encouraged to use descriptive rather than general praise statements (Wolery, Bailey, & Sugai, 1988). Extensive research exists on the effects of contingent praise and social attention, but little exists on the effects of descriptive as compared to general praise. One study was found that compared labeled (descriptive) and unlabeled (general) praise; labeled praise included naming the behavior being praised in the praise statement, and unlabeled included statements such as "good" or "way to go" but did not name the behavior (Bernhardt & Forehand, 1975). Labeled praise was more effective in changing behaviors. No studies were found that determined whether behaviors other than the one being praised could be taught by including them in the descriptive praise statement.

Constant time delay is a parsimonious and minimally intrusive and restrictive procedure. It has been used to teach food preparation skills (Schuster, Gast, Wolery, & Guiltinan, 1988), manual sign production (Browder, Morris, & Snell, 1981), and sight word reading (Koury & Browder, 1986). It is more efficient in terms of trials, errors, and instructional time than the system of least prompts (Gast, Ault, Wolery, Doyle, & Belanger, 1988) and is at least as efficient as progressive time delay (Ault, Gast, & Wolery, 1988). Recently, it has been used effectively in a group arrangement with preschoolers (Alig et al., 1988).

Three research questions were addressed in this study. First, would constant time delay be effective in teaching adolescents with learning and/or behavior disorders? Second, would specific or general attentional responses differentially affect the acquisition of (a) target behaviors, (b) other group members' target behaviors (observational learning), (c) behaviors presented in descriptive praise statements for the target student (incidental learning), and (d) behaviors presented in descriptive praise statements for other group members (incidental-observational learning)? Third, would students acquire information presented in the descriptive praise statements?

Methods

Participants and Setting

Five students, two males and three females, participated in this study. At the onset, four subjects were involved, but one (Paula) moved from the school district and another subject (Mary) was added. Ann was 14-yrs, 11-mos and diagnosed as having learning disabilities; Tom was 14-yrs, 8-mos and diagnosed as behaviorally disordered; Mary was 15-yrs, 2-mos and diagnosed as learning disabled; and Charlie was 15-yrs, 11-mos and diagnosed as behaviorally disordered. All were placed in a special education resource room. Prior to the study the following prerequisite skills were assessed: the ability to (a) sit and attend to task stimuli for 20 minutes with three other classmates present, (b) verbally imitate 3-word statements, (c) wait 4 seconds for prompt delivery, (d) respond correctly to verbal directions, and (e) select a reinforcer.

All probe sessions were conducted in a 1:1 instructional arrangement, and all instructional sessions used a group arrangement. All sessions occurred at a table (2.5 x 6 feet) located in the back of a resource room (24 x 26.25 feet). The instructor and subjects were situated so that all stimulus cards and corresponding responses were visible and audible to all group members. During the sessions, three other students doing independent seatwork were present in the class. The resource room teacher conducted experimental sessions; a research associate assisted during the teacher's absences and assessed incidental learning throughout the study.

Materials

A total of 64 facts, relevant to the subjects' educational curriculum and/or individualized educational program, were presented. Each fact was printed in black ink, with upper and lower-case letters, on cards (8.5 X 11 inches). The discriminative stimuli were printed on the front of the cards, and the back of the cards contained the correct response, incidental information (if provided for that stimulus item), and a prompt to indicate the required attentional response. Candy bars and soft-drinks were awarded as reinforcers. Each subject also had a daily performance monitoring chart.

Response Definitions and Data Collection

Data were collected continuously on the subjects' expressive responses. Also, attending behaviors for all group members were recorded on 10 randomly selected trials during instructional sessions and all trials during probe sessions. Attending responses were recorded as either "attending" or "non-attending". When a general attentional response was used, attending was defined as looking at the card containing the discriminative stimulus. When a specific response was used, it was defined as looking at the card while the targeted subject orally repeated the discriminative stimulus.

During probe conditions, three responses were scored: Corrects, incorrects, or no responses. Corrects were defined as the subject correctly stating the answer within the 4-sec response interval. Incorrects were the subject incorrectly stating the answer within the 4-sec response interval. No responses were the subject saying nothing within the 4-sec response interval.

Six possible responses were recorded during instruction. Correct anticipations were defined as the subject correctly stating the answer within the 4-sec response interval. When a general attentional response was used, the response interval began after the instructor held up the card, instructed the group to look at the card, and read the discriminative stimulus from the card. When a specific attentional response was used, the response interval began after the targeted subject had repeated the discriminative stimulus from the card (following the instructor's presentation as with a general attentional response). Correct waits were the subject correctly repeating the answer within 4 sec of the instructor's model. Non-wait errors were the subject incorrectly stating the answer prior to the delivery of the instructor's prompt. Wait errors were the subject incorrectly repeating the answer within 4-sec of the prompt delivery. No responses were the subject saying nothing within 4 sec of the prompt delivery. Interferences resulted when another subject said a correct or incorrect answer prior to the targeted subject emitting a response.

Procedures

General procedures. One 64-trial instructional session was conducted daily (five days per week) and occurred if at least two subjects were present.

Group instruction was intrasequential in nature, and the trial presentation used a combination concurrent/sequential approach (Reid & Favell, 1984).

Four instructional sets were presented throughout the course of the study. Each subject had four targeted responses in each of the four sets for a total of 16 responses. During each instructional condition, a general attentional response was used with half of the stimuli while a specific attentional response was used with the other half. In addition, incidental information was provided in descriptive praise statements for half of the stimuli. Thus, each subjects four targeted behaviors for each set were presented using these four conditions: specific attentional response with incidental information, specific attentional response without incidental information, general attentional response with incidental information, and general attentional response without incidental information. A total of 16 stimulus facts (4 per subject) was presented to the group in each instructional condition and were were randomly presented 4 times in each session. All stimuli were presented once, prior to repeating any others. Also, no subject received more than two consecutive turns and no fact was presented on more than one successive trial.

Correct responding resulted in verbal praise on a continuous reinforcement (CRF) schedule that was thinned to a VR-3 schedule (praise was delivered on the average of every three correct responses) after criterion levels were attained during instructional conditions and in the last two sessions during the final probe condition (Probe V). For half of the behaviors, descriptive praise statements contained an additional fact (incidental information). Incorrect or no responses were ignored. Tangible reinforcers were delivered at the end of sessions for compliance with the task and attentional responses.

Identification of targeted information/facts. A total of 64 facts (16 per instructional condition) were selected for instruction. By sets, the following type of information was taught: The functions of federal offices, the services provided by local offices/agencies, over-the-counter medications, and the effects of specific vitamins/minerals on the body. The incidental information by sets was the names of the people who headed those offices, additional services these agencies offered, and brand names or foods that contained the drugs or vitamins/minerals, respectively.

Probe procedures. Each subject received a minimum of 4 probe sessions, two assessed targeted behaviors for that subject and two assessed all stimuli in the study. In the latter sessions, half of the stimuli were assessed during the first session (32 trials) and the remainder in the second. The sessions that evaluated only targeted behaviors also contained 32 trials (with the exception of the final probe condition which had 44 trials). The number of trials per behavior varied across probe conditions; emphasis (more trials) was placed on behaviors just trained and on those targeted for training in the next set.

In all sessions, half of the trials used a general attentional response while the other half used a specific response. All behaviors were presented with both attentional responses during probe conditions. The attentional response for each behavior was alternated across probe conditions.

Observational/Incidental learning assessments. Acquisition of behaviors targeted for other group members and of incidental information from descriptive praise statements was evaluated in 1:1 probe sessions. During Probes I and V, all the behaviors taught in the study were assessed with each subject, while only the behaviors just taught or to be taught in the next instructional set were assessed in Probes II, III, and IV.

<u>General and specific attentional responses</u>. During each instructional set, 8 of the 16 stimuli (2 stimuli per subject) were taught with a general attentional response and the other 8 stimuli with a specific attentional response. With a general response, the teacher held up the card and instructed the entire group to look. She then said the targeted subject's name and read the discriminative stimulus in the form of a question. The specific attentional response included the above, and the instructor told the target student to repeat what she said. If the targeted subject did not comply with the requested attentional response, he/she was verbally prompted to do so. Ten trials in each instructional session were randomly selected for recording the group's attending behaviors.

<u>Constant time delay</u>. The first session in each instructional condition was 32 trials and used a 0-sec delay interval. All subsequent sessions for that set consisted of 64 trials and a 4-sec delay interval. Each trial began with the attentional cue. The response interval (0- or 4-sec) began after the targeted subject engaged in the appropriate attentional response and the discriminative stimulus was read from the card. If the subject had not responded within the allocated response time, the prompt was delivered by the instructor. The prompt involved both visual and auditory cues: The instructor showed the back of the card with the answer printed on it and said the correct answer.

Correct anticipations and waits resulted in verbal praise. Half of the stimuli presented in the study also received descriptive verbal praise (incidental information). Subjects were expected to have at least 94% (15/16 trials) correct waits and/or anticipations, and at least 80% appropriate attending behaviors to receive a back-up reinforcer at the end of each session. Praise was delivered on a CRF schedule until the entire group met the criteria of 100% correct anticipations, and then was thinned to a VR-3 schedule until a minimum of two consecutive sessions with 100% correct anticipations occurred for all group members

Errors and no responses were ignored. Differential reinforcement was provided if a subject's percent of correct anticipations did not increase after three consecutive sessions. Verbal praise was delivered, but the back-up reinforcer was contingent upon a higher percentage of correct anticipations.

Review trials. Review trials of previously taught stimuli were conducted prior to each instructional session, beginning with Instruction II. Each subject received one review trial per day using a general attentional response; praise was delivered for correct responding. Errors or no responses resulted in the teacher saying, "No", then providing the correct response.

Experimental Design

The experimental design was a modification of the parallel treatments design (Gast & Wolery, in press) which can be conceptualized as concurrently implemented multiple probe designs (Tawney & Gast, 1984). The constant time delay procedure was used in four separate conditions that were simultaneously implemented, using all possible combinations of two attentional responses (general and specific) and praise statements (with and without incidental information). Instructional conditions were: (a) probe all behaviors in 1:1 sessions; (b) simultaneously implement the four instructional conditions in daily group sessions for Set 1 behaviors; (c) probe, in 1:1 sessions, behaviors from the set just taught and the set to be taught; (d) simultaneously implement the four instructional conditions in daily group sessions for the next set to be taught; (e) repeat conditions with Set 3 and

Set 4 until all behaviors have been taught, and (f) probe all behaviors taught in 1:1 sessions.

Reliability

Reliability assessments on subject responding and procedural implementation (Billingsley, White, & Munson, 1980) were conducted by a trained observer. To calculate dependent measure reliability estimates, the number of agreements divided by the number of agreements plus disagreements multiplied by 100. Procedural reliability estimates were calculated by dividing the number of observed teacher behaviors by the number of planned behaviors and multiplying by 100. The following behaviors were assesed: presenting the stimulus, requesting the group to attend, securing the appropriate attentional response from the targeted subject, presenting the discriminative stimuli, waiting the specified response interval, delivering the controlling prompts and consequences correctly, and implementing the 3-5 second intertrial interval.

Results

Reliability Results

Reliability measures were collected during 29 of the 82 (35.4%) probe sessions and during 21 of the 52 (40.4%) instructional sessions. The mean percent of agreement on student responding during probe conditions was 99.3% (r = 98.3% to 100%) and during instructional conditions was 99.8% (r = 99.4% to 100%). During probe conditions, procedural reliability for presenting the stimuli and delivering the instructional cue was 100%. Requesting the correct attentional response was 99.2% (r = 96.9% to 100%); ensuring the targeted subject complied with the correct attentional response was 96.4% (r = 94.9% to 98.8%); waiting the correct response interval was 99.0% (r = 95.8% to 100%); consequating student responses correctly was 98.8% (r = 97.5% to 99.6%); and

The number of trials, number of errors, and percent of errors to criterion were analyzed for each subject by each of the four attentional response/feedback conditions. This analysis indicates that the type of attentional response did not differentially influence the number of trials (528 for specific and 532 for general) or the percent of errors (2.7% for specific and 2.3% for general) to criterion. The presence of incidental information in the descriptive praise statement did not differentially influence the number of trials (536 with information and 524 without), but did increase the percent of errors (3.2% with information and 1.7% without). Although the error percentage was nearly twice as high when incidental information was added to the descriptive praise statement, the percent of errors in both conditions was low.

Observational Learning

When measured, students attended on 98.3% of the trials, and none were below 80% for a single session. Each student learned some behaviors targeted for other group members (observational learning). Observational learning on each set was assessed four times during the study: prior to instruction, when students first reached 100% correct anticipations, in the probe condition following instruction, and at the conclusion of the study. As presented in Table 2, students learned some but not all of their group members' targeted responses. Much of that learning occurred before they displayed 100% correct anticipations on their own targeted responses. However, in most cases, students increased their observational learning performance slightly in the probe condition following instruction. Thus, from the first session where a student performed at 100% correct anticipations until the group met criterion on that set, some observational learning occurred. When the results are analyzed by the type of attentional response, differential effects are noted waiting the intertrial interval was 99.9% (r = 99.6% to 100%). During instructional conditions, a mean of 100% agreement was evident for presenting the stimulus, delivering the instructional cue, and waiting the correct intertrial interval. Agreement percentages for requesting and ensuring the correct attentional responses were 99.5% (r = 99.1% to 100%) and 97.7% (r = 96.9% to 100%), respectively; waiting the correct response interval was 99.1% (r = 98.0% to 100%); and consequating correctly was 98.9% (r = 96.9% to 99.3%).

Effectiveness

The percent of correct responses for the group is shown in Figure 1 and for each probe condition by type of attentional responses for each student is shown in Table 1. At the onset of the study (Probe I), correct responding for all targeted behaviors was 0% across all subjects. This level maintained on each instructional set prior to training with the exception of Probe II for Tom who responded correctly to one of his targeted behaviors for the second instructional set. Implementation of the constant time delay procedure resulted in criterion level responding on all target behaviors for all students. The only modifications required for establishing criterion level responding was the use of differential reinforcement for correct anticipations only. This change was used for Ann on Set I and Set IV and for Tom on Set I. High levels of correct responding were maintained on all behaviors taught throughout the study, even when reinforcement schedules were thinned. As shown in Table 1, Mary did not receive instruction during the first instructional condition because she joined the group at the beginning of Probe II after another subject moved away. Similarly, due to a prolonged absence, Charlie did not receive intervention on behaviors targeted for Set IV.

Insert Figure 1 and Table 1 about here

over time. Initially, performance was essentially equal for both types; however, when measured in the probe condition following instruction, students were more likely to be correct on facts taught with specific attentional responses. Further, during the final probe, a clear difference is noted in that all students performed higher on facts taught with the specific attentional response.

Insert Table 2 about here

Incidental Information

Half of the stimuli included incidental information in the descriptive praise statement and half did not. Initially, all subjects had 0% correct responses on all of the incidental information. They continued at this level on stimuli that did not receive incidental information with the exception of one behavior presented in the second instructional condition. For this stimulus item, a guest speaker provided the information.

Target incidental information. The percent of correct responses on target incidental information during the final probe condition are shown in Table 3. The group had a mean percent of 82.1 (23/28 trials) correct responses on stimuli that received incidental information, and 3.1% (1/32 trials) on behaviors where it was not presented. Students were more likely to learn their incidental information if the behaviors were taught with the specific attentional response (92.9%, 13/14 trials) than the general attending response (71.4%, 10/14 trials).

Insert Table 3 about here

Observed incidental information. Students' performance on incidental information that was presented to other students also was analyzed. Students learned 37.2% (29/78 trials) of the incidental information presented to other students and 2.6% (2/78 trials) of the information that was not presented. However, for the behaviors taught with the specific attentional response, they performed at 51.3% (20/39 trials) and for the general attentional response they performed at 23.1% (9/39 trials).

Discussion

The purposes of this study were to (a) evaluate the effects of constant time delay in a group format with adolescents who displayed learning and behavioral disabilities, (b) identify the role of attentional responses on acquisition of target behaviors, observational learning, and incidental learning, and (c) investigate the acquisition of incidental information from descriptive praise statements. Based on the findings of this study, four statements can be made.

First, the constant time delay procedure was implemented reliably in the group context. Most of the research with this and other errorless learning procedures has been conducted in 1:1 rather than group arrangements. This study indicates that the procedure can be used by an experienced teacher with few procedural errors in small group settings. Whether such implementation would occur when group size increased, content was varied, and the teacher was inexperienced is open to study. The constant time delay in this study, however, was more complex than usual because it included two attentional responses and different feedback for half of the correct responses.

Second, data presented in Figure 1 and Table 1 indicate that the constant time delay procedure was effective. In all cases, criterion level performance was established which replicates earlier work with the procedure in 1:1 sessions (Ault et al., 1988; Gast et al., 1988) and small group arrangements

(Alig et al., 1988). It also extends earlier work with students who have learning and behavior disorders; previously spelling (Kinney, Stevens, & Schuster, 1988; Stevens & Schuster, 1987) and sight words (Precious, 1985) were taught. Social studies and health content was taught in this study. The low error percentages and the small number of trials to criterion in this study are similar to those found in previous investigations. The reliable implementation and effectiveness of the procedure suggests that the constant time delay procedure is a viable instructional strategy for students with learning and behavior disabilities. Although the procedure originated from the literature on the severely handicapped, it appears to have applications to students with learning disabilities. Studies comparing it to common instructional procedures with this population are needed, however.

Third, the effects of the attentional responses were quite consistent. The general and specific attentional responses did not appear to differentially affect students' acquisition of their target responses. However, the type of attentional response affected observational and incidental learning. Students maintained more of their observational learning when the behavior was taught with a specific attentional response. This is consistent with a similar study with preschool children and pre-academic content (Alig et al., 1988). Students also learned more of the incidental information from the descriptive praise statements when the stimuli were presented with the specific attentional response. Further, students learned more of other group members' incidental information when a specific attentional response was used. The consistency of these findings is surprising because the difference between the two attentional responses was simply having the student repeat the question in the specific attentional response condition. Further research is needed to investigate other types of attentional responses and to identify the effects of fixed or variable attentional responses.

Fourth, students learned information that was placed in the descriptive praise statements. This study documents that when information other than the behavior being praised is placed in the praise statement, students may learn it incidentally. This study also suggests that when the target stimulus is presented with a specific attentional response, the probability of learning the incidental information is increased. Further research on this issue is needed. For example, could instruction be made more efficient if the content to be taught in the near future was presented in the descriptive praise statement? Will students learn information in the descriptive praise statement if a variety of information is presented rather than the same information on each trial? Can students learn rules (e.g., phonetic rules) when they are incidentally inserted in the praise statements? What other variables can increase the amount of learning from the praise statements? The answers to these and similar questions should have immediate impact on teaching practices.

In terms of practical implications from this study, it is clear that the constant time delay procedure is an effective strategy in small group instruction with students who have learning and behavior disabilities. However, comparison with more usual teaching practices are needed. It also appears that the attentional response used in direct instruction may be a critical variable in the amount of observational and incidental learning that occurs and maintains. Until the relationships between attentional responses and such learning is more clearly identified, it is reasonable to use the specific attentional response employed in this study.

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Table 1

Mean Percent of Correct Responses for Each Probe Condition and Each Student

Student Instructional Set		Attentional Response	Probe I	Probe II	Probe III	Probe IV	Probe V
				Probe Conditions[a]			
ANN							
	Set I	Specific	0	100	100	100	100
		General	0	89	100	100	75
	II	Specific	0	0	100	100	100
		General	0	0	100	100	100
	III	Specific	0	0	0	100	100
		General	0	0	0	100	100
	IV	Specific	0	0	0	0	88
		General	0	0	0	0	100
TOM							
	Set I	Specific	0	100	100	100	100
		General	0	100	100	100	100
	II	Specific	0	17	100	100	100
		General	0	0	100	100	75
	III	Specific	0	0	0	100	100
		General	0	0	0	100	100
	IV	Specific	0	0	0	0	100
		General	0	0	0	0	100
MARY							
	Set I	Specific	---	0	0	0	0
		General	---	0	0	0	0
	II	Specific	---	0	100	100	100
		General	---	0	100	0	100
	III	Specific	---	0	0	100	100
		General	---	0	0	100	75
	IV	Specific	---	0	0	0	100
		General	---	0	0	0	100
CHARLIE							
	Set I	Specific	0	94	100	100	---
		General	0	94	50	50	---
	II	Specific	0	0	100	100	---
		General	0	0	100	100	---
	III	Specific	0	0	0	100	---
		General	0	0	0	100	---
	IV	Specific	0	0	0	0	---
		General	0	0	0	0	---

[a] Lines through figures indicates when training was initiated and completed.

Table 2

Percent of Correct Responses on Observational Learning Trials by Subject, Attentional Response, and Measurement Occasion

Student / Attentional Response	Measurement Occasions: Initial Probe	First Session at 100% Correct	Probe After Criterion	Final Probe
Ann				
Specific	0	31.8	57.7	56.8
General	0	36.4	30.8	22.7
Tom				
Specific	0	54.5	65.4	65.9
General	0	59.1	69.2	59.1
Mary				
Specific	0	25.0	50.0	53.1
General	0	12.5	40.0	31.3
Charlie				
Specific	0	22.2	27.8	44.4
General	0	22.2	33.3	33.3
Totals				
Specific	0	34.6	52.2	57.2
General	0	34.6	44.4	37.7

Table 3

Percent of Correct Responses on Targeted and Observational Learning of Incidental Information by Subject and Attentional Response

Student Attentional Response	Type of Incidental Information: Targeted Information (Provided for the Students Own Facts)	Observational Information (Provided for Other Students' facts)
Ann		
Specific	100	54.5
General	100	18.2
Tom		
Specific	75	72.7
General	75	18.2
Mary		
Specific	100	50
General	66.7	50
Charlie		
Specific	100	22.2
General	33.3	11.1
Totals		
Specific	92.9	51.3
General	71.4	23.1

Figure Caption

Figure 1. Mean percentage of correct responses for the group across instructional sets. The triangles indicate the percentage of correct anticipations and the circles indicate the percentage of correct waits.

Appendix K

Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Meyer, S. (1989). The effective use of the system of least prompts in a small group instructional arrangement. Manuscript submitted for publication.

System of Least Prompts and Incidental Learning in a Small Group Instructional Arrangement[1]

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Abstract

This investigation examined the effectiveness and efficiency of a system of least prompts procedure in a small group instructional arrangement. Four primary-aged students in a self-contained public school classroom for students with moderate handicaps were taught to read food words found on restaurant menus. In addition, students' acquisition of incidental information (i.e., the approximate cost of the food and at what meal the food is normally consumed) was assessed across each instructional condition. The incidental information was presented in the instructional procedure's prompt hierarchy during instruction. A multiple probe design across word sets was used to assess the effectiveness of the system of least prompts procedure in the small group instructional arrangement. The results indicated that: (a) the system of least prompts procedure was effective in teaching food words to each of the four students in a small group instructional arrangement; and (b) each student acquired some of the non-targeted incidental information. The results are discussed in terms of designing efficient small group instructional arrangements while using effective instructional strategies.

System of Least Prompts and Incidental Learning in a Small Group Instructional Arrangement

The system of least prompts is a response prompting procedure that is effective in teaching a variety of skills to a wide range of persons with handicaps in one-to-one instructional arrangements (Doyle, Wolery, Ault, & Gast, 1988). Examples include teaching leisure skills to an adult with severe impairments (Giangreco, 1983), community living skills to secondary-aged students with moderate disabilities (Cronin & Cuvo, 1979), self-care skills to primary and secondary-aged students with mild and moderate retardation (Horner & Keilitz, 1975), and a vocational skill to secondary students with moderate and severe handicaps (Horner & McDonald, 1982). The procedure also has been effective in teaching discrete skills: manual signs (Duker & Michielson, 1983); receptive and expressive identification of pictures (Hupp, Mervis, Able, & Conroy-Gunter, 1986); reading of recipe words (Gast, Doyle, Wolery, Ault, & Farmer, in press); and prepositions, pronouns, and sentences (Konstantareas, 1984). Because of this generality, the procedure is a viable instructional option for teachers of students with handicaps.

Although the system of least prompts has been used extensively in one-to-one instruction, few studies have examined its use in small group instructional arrangements (Alberto, Jobes, Sizemore, & Doran, 1980). Small group instruction is a practical alternative to one-to-one instruction in many classrooms (Reid & Favell, 1984).

Advantages of this instructional format include (a) improved use of teacher time (Westling, Ferrell, & Swenson, 1982), (b) increased use of an instructional format similar to those found in less restrictive placements (Fink & Sandall, 1978), and (c) increased opportunities to interact and learn from peers (Alberto et al., 1980). These advantages argue for the use of small group instruction but do not preclude the use of systematic instructional procedures. For example, response prompting procedures such as constant and progressive time delay have been effective in small group arrangements (e.g., Ault, Wolery, Gast, Doyle, & Martin, in press; Cybriwsky, Wolery, & Gast, in press; Doyle, Gast, Wolery, Ault, & Farmer, 1990; Farmer, Gast, Wolery, & Winterling, 1989). Schoen and Sivil (1989) used the system of least prompts to teach self-care skills to dyads of preschoolers. Thus, additional research is needed to evaluate the system of least prompts in small group arrangements.

In addition to effectiveness, the efficiency of instructional procedures is an important consideration. When compared to response prompting strategies such as constant (Gast, Ault, Wolery, Doyle, & Belanger, 1988) and progressive time delay (Bennett, Gast, Wolery, & Schuster, 1986), the system of least prompts was less efficient in terms of the number of trials, errors, and minutes of instructional time. However, those differences diminish as the procedure is repeatedly used (Doyle, Wolery, Gast, Ault, & Wiley, 1990). In the Schoen and Sivil (1989) study with preschool dyads, the system of least prompts strategy was compared to a constant time delay procedure. Each of the procedures was effective but the constant time delay procedure was slightly more efficient.

Another means of evaluating efficiency is to measure the amount of information learned that is not directly taught. For example, small group arrangements may increase the efficiency of instruction because group members may acquire behaviors taught to other students through observational learning (Oliver & Scott, 1981; Orelove, 1982). Further, with the system of least prompts students may learn additional information from the prompt levels. The system of least prompts consists of a target stimulus, a prompt hierarchy of least-to-most assistance, and the opportunity to respond independently at each level of the hierarchy. If a correct response occurs following delivery of the target stimulus, reinforcement is provided; if an error or no response occurs, the prompt that provides the least amount of assistance is delivered followed by another opportunity to respond. This sequences is repeated until all of the prompts in the hierarchy have been delivered or the student makes a correct response. An "underlying assumption is that less intrusive prompts will acquire control of the student's behavior" (i.e., the student learns this information and uses it to make the correct response) (Doyle et al., 1988, p. 37). It may be possible to design prompts in the prompt hierarchy that would allow students to learn new non-target information. Gast et al. (in press) taught four secondary-aged students with moderate mental retardation to read recipe words using both progressive time delay and the system of least prompts in one-to-one instruction. Nontarget information related to the recipe words was presented in the praise statements following correct responses with both procedures and as prompts in the system of least prompts condition. The results indicated that both procedures were effective in establishing reading of the recipe words and that students learned some of the related nontarget information.

The purpose of this study was twofold. First, the effectiveness of the system of least prompts was evaluated in teaching menu reading in a small group arrangement to students with moderate retardation. Second, the study evaluated whether students acquired related nontarget information presented in the prompt hierarchy. The nontarget information consisted of the approximate cost of the menu item and the meal in which the food was normally consumed. Specifically, the prompts for some menu words were "it costs less than a dollar" and "we eat it for breakfast"; the prompts for other menu words were "it costs more than a dollar" and "we eat it for dinner." Students were assessed to determine whether they learned to classify the menu words according to their approximate cost (i.e., more/less than a dollar) and the meal (breakfast/dinner) in which they were normally eaten.

Methods

Participants and Setting

Three males and one female ranging in age from 7 to 9 years old, enrolled in a public school classroom for children with moderate handicaps, participated in the study. All students met the following prerequisite entry criteria: (a) intact auditory and visual systems (students consistently responded to auditory and visual stimuli with corrective appliances when necessary); (b) appropriate attending behaviors in a group (students sat and made eye contact with the teacher and materials for 15 minutes within the small group arrangement); (c) previous history with systematic response prompting procedures (students waited up to 4 sec for a prompt and orally imitated an expressive teacher model); and (d) minimal sight word reading ability (students could identify at least three survival words). Additional information about each student is presented in Table 1.

Insert Table 1 about here

Instructional sessions were conducted by the classroom teacher in the subjects' (6.4m x 8.9m) classroom. All subjects were seated together at a semicircular table located in the back of the classroom. The instructor and students were arranged so all word cards were visible and so teacher and student responses were audible to each member of the group. Students not involved in the study participated in their regular classroom activities with the classroom assistant.

Materials

A total of eight food words found on a local restaurant menu were selected for instruction. The classroom staff were given the list of words to ensure that target words were not taught during classroom activities. Each word was printed in black lower case letters (i.e., as it appeared on the menu) on the front of white index cards (10 cm x 15 cm). The back of each word card contained written instructions for the teacher relative to the prompt hierarchy including the type of incidental information to be delivered and order of presentation for that food word. A colored picture for each food word was used for testing the sight word referent and as one of the prompts in the hierarchy. The pictures were obtained from a restaurant menu and laminated onto 10 cm x 15 cm index cards. The reinforcers selected as prizes for students included small candies, crackers, and a variety of children's stickers. Target words, incidental information, and the order of instruction are presented in Table 2.

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Insert Table 2 about here

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Experimental Design

A multiple probe design (Tawney & Gast, 1984) across word sets, replicated across students, was used to evaluate the effectiveness of the system of least prompts procedure. Differential reinforcement of correct and incorrect responses during probe trials minimized the differences between probe and instructional conditions, increased the probability that students would respond in the probe condition, and decreased the probability that probe data were a deflated representation of the students' ability to perform the correct response. Individual pretests occurred to assess students' ability to read the eight targeted food words and to measure knowledge of the incidental information assigned to each word. The experimental conditions were: (a) probe all target words in one-to-one sessions and assess knowledge of the incidental information to be presented as prompts with Word Set 1; (b) teach Word Set 1 with the system of least prompts in the group until all students reached criterion level responding; (c) conduct daily individual probe trials on Word Set 1; and (d) probe all target words and assess acquisition of the incidental information from Word Set 1 and Word Set 2. This sequence was repeated until all four word sets had been taught.

Assessment Conditions

Pretests and posttests. This investigation included a number of measures used to select the target words and assess student knowledge of incidental information before and after instruction. Prior to beginning the investigation and during each subsequent probe condition, four individual assessment sessions were conducted for all measures and students. Descriptions of the measures, the times of assessment, and criteria for selecting words as target stimuli are shown in Table 3. Students were able to select a prize prior to beginning the session, to be delivered non-contingent of performance, following completion of the test sessions. However, all correct, incorrect, and no responses during the sessions were followed by the teacher waiting a 3-5-sec intertrial interval and presentation of the next trial.

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Insert Table 3 about here

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Probe conditions. Prior to instruction on each set of menu words, students were assessed on their ability to read both trained and untrained words. Each student was assessed individually and received a total of 20 trials per probe session (two trials on each of the eight target words and two trials on two known line drawings). The two known drawings were included to ensure that students received reinforcement for correct responding during probe sessions. All probe trials consisted of the instructor holding the word card in front of the student, presenting the attending cue ("Name, look here."), ensuring the attending response, delivering the task direction ("What word?"), and providing a 3 sec-response interval. If the student responded correctly during the response interval, the teacher confirmed the correct response (e.g., "Good, that is the word eggs.") and allowed the student to select a reinforcer. If the student did not respond or responded incorrectly, the teacher ignored the error, removed the word card, waited a 3 to 5-sec intertrial interval, and presented the next trial.

Daily probe trials. Daily probe trials were conducted to assess whether a student's correct response during instructional sessions was a function of having learned to read the word or a result of imitating other students' models of correct responses. Prior to the group session, the teacher approached an individual student and conducted one trial for each of the two menu words currently receiving instruction. The daily probe trials were identical to trials conducted in probe conditions. When the two individual probe trials were completed, the teacher told the student that it was time to work and asked the student to go to the table. This continued until all students were seated at the table.

Review trials. Beginning with instruction on menu words from the second word set, each student received one review trial on a previously learned target word to monitor maintenance of the learned words. The review trials were conducted after the students were seated at the table but prior to beginning instruction of current target words. The review trials were identical to the probe trials with the exception of the consequent event for errors. All incorrect responses were followed by an error correction procedure consisting of a mild verbal reprimand (e.g. "That is wrong.") and a verbal model of the correct response (e.g., "This word is eggs.").

Instructional Procedures

Group procedures. Eight food words from a local restaurant menu were targeted for instruction in a small group arrangement using a system of least prompts procedure. The eight words were divided into four word sets; each set consisting of two words. Instruction continued on a word set until all students reached criterion level responding; that is, 100% correct responding to the task direction alone during group instruction and on individual daily probe trials, one session using a continuous schedule of reinforcement (CRF), and one session with approximately every third correct response receiving reinforcement (VR3). One or two group instructional sessions were conducted each day. If two instructional sessions were conducted in one day, the minimum time between sessions was three hours. Group instruction was intrasequential; that is, instruction was provided to each member of the group individually without systematic structured interaction between the students. The target words were presented randomly within each instructional session of 16 intermixed trials with four trials presented to each student; two trials on each target word in a set, across students. Students did not receive more than two consecutive turns and no target word was presented on more than two consecutive trials. A general, inactive, group attending cue ("Everybody ready?") was presented prior to beginning a student's instructional trial.

System of least prompts (SLP). Two words were assigned to each instructional condition. During each trial, the teacher moved through a hierarchy of prompts consisting of level 1, the task direction alone (i.e., "What word?"); level 2, the task direction paired with a verbal prompt indicating the cost of the item (i.e., "What word?" "It costs more [or less] than a dollar.'); level 3, the task direction paired with a verbal prompt labeling the meal when the target food is consumed (i.e., "What word?" "We eat it for dinner [or breakfast]."); level 4, the task direction in addition to a visual prompt showing a picture of the target food (i.e., "What word?" picture); and level 5, the task direction paired with a verbal model of the correct response (i.e., "What word?" "Food name.").

Prior to each instructional trial the teacher provided the group attending cue and ensured attending responses from all students. This was followed by a student's name, presentation of the attending cue, and delivery of the task direction (e.g., "Name, look, what word?"). Delivery of the task direction was followed by the teacher waiting a 3-sec response interval. If the student did not respond, the teacher repeated the task direction and presented the first prompt in the hierarchy (the approximate cost) and waited another 3 sec for a student response. If the student did not respond, the teacher repeated the task direction and presented the second verbal prompt (i.e., told the student when we eat the food) and waited an additional 3 seconds. Another student "no response" was followed by teacher delivery of the task direction, the picture of the food, and another 3-sec response interval. If the student still did not respond, the teacher stated the task direction, modelled the correct response, and waited 3 seconds.

If the student made an error before a prompt was delivered (unprompted error) or responded incorrectly after delivery of any prompt in the hierarchy (prompted error), the teacher said, "No wait, and I'll help you.", repeated the task direction and delivered the next prompt in the hierarchy. If the student made the correct response to the task direction alone (unprompted corrects) or after a prompt (prompted corrects), the teacner delivered descriptive verbal praise including confirmation of the correct response (e.g., "Good, that is the word bacon.") and an edible or sticker. Only unprompted correct responses counted toward criterion. If an individual student attained criterion on the target words before other members in the group, the student remained in the group and received instructional trials as usual.

Reliability

Dependent measure reliability estimates. Reliability observations were conducted by a research associate twice weekly and at least once during each experimental condition on student responses to each trial. A point-by-point method (number of agreements divided by number of agreements plus disagreements multiplied by 100) was used to calculate reliability.

Procedural reliability estimates. The instructor's fidelity with the experimental procedures in the probe a .nstructional conditions was also assessed (Billingsley, White, & Munson, 1980). These measures included recording total session length, presenting the correct word card, delivering the attending cue, securing an attending response, presenting the task direction, waiting the specified response interval prior to delivery of a prompt, delivering the correct prompt, delivering the appropriate consequent event, and waiting the specified intertrial interval. The instructor's behavior was observed and compared to a description of the experimental procedures. Procedural reliability estimates were calculated by dividing the number of actual instructor behaviors by the number of planned behaviors and multiplying by 100. Estimates were calculated for each condition, on each behavior, for each student in the group.

Results

Reliability

Interobserver reliability on student responding and the teacher's adherence to the written description of the procedures occurred in 32.9% of the probe sessions, and in 31.3% of the instructional sessions. The mean percentage of agreement on student responding during probe and instructional conditions was 100% across all students in the group. In the probe conditions, the mean percentage of agreement on procedural reliability was 100% on all behaviors and students. In SLP conditions, the mean perc ntage of agreement was 100% on all variables across students except delivering the correct prompt (mean=99.8%, range=95%-100%).

Effectiveness

The mean percentages of correct responding for Tommy, Chris, Delbert, and Carrie to the eight target words during instructional and probe conditions, and the order in which the words were introduced are shown in Figures 1, 2, 3, and 4, respectively.

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Insert Figures 1, 2, 3, and 4 about here

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For Tommy, Chris, and Delbert the percentage of correct responding to untrained target words was zero across all word pairs during the probe conditions. The use of the system of least prompts procedure in a small group instructional arrangement was effective in establishing criterion level responding for four pairs of words for Tommy and Chris. Because Delbert was placed into a new classroom at another school, he was only taught three pairs of target words. In the probe conditions immediately following instruction, Tommy's performance maintained at 100% correct on all trained words across all probe sessions. For Chris, the percentage of correct responding was 100% in all sessions from Probes II, III and IV and 100% in the final three sessions of Probe V. Delbert's percentage of correct responding on trained words was at 100% in two out of three probe sessions in Probe conditions II, III, and IV.

For Carrie, the percentage of correct responding to untrained words was also at zero in Probe I. In the first group instructional condition, system of least prompts was not effective in establishing criterion level responding. Therefore, changes were implemented to teach the first set of words to Carrie: (a) differential reinforcement of unprompted and prompted correct responses (i.e., only unprompted correct responses were followed with reinforcement); (b) one-to-one supplemental instruction (i.e., Carrie continued to receive instruction during the small group arrangement using the SLP procedure; however, she also received individual training sessions using SLP); and (c) when these changes were not effective in establishing criterion level responding, Carrie was removed from the group session and only received instruction on Word Set 1 in a one-to-one session using a constant time delay procedure. The implementation of the final change was effective in teaching the first two words to Carrie and performance maintained at criterion level in Probe II. Because of the length of time required to implement these changes, the remaining members of the group were taught Word Set 2 without Carrie. When instruction began of Word Set 3, Carrie returned to the small group instructional arrangement and SLP was effective in teaching two new words. Her performance on Word Sets 1 and 3 maintained at 100% in the fourth probe condition. Although Carrie had not received instruction on Set 2 words, her correct performance on these untrained words during Probe III was 93%. This increase in performance without training might have been a result of her exposure to the correct response for each word from Set 2 during review trials; each word from Set 2 was reviewed a total of 10 times for Tommy, Chris, and Delbert during instruction on Set 3 words. The target words in Set 4 remained at zero until SLP was implemented in the fourth instructional condition. The SLP strategy in the small group arrangement was effective in teaching the remaining two words to Carrie. Her performance in the final two sessions of the final probe was 100% across the 12 target words.

In each instructional condition, correct responses by the students transferred from the most intrusive level of information to prompts that provided less information and finally to the independent or task direction level of the hierarchy. The number and type of prompt delivered across students for each instructional condition is shown in Table 4.

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Insert Table 4 about here

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Efficiency

Efficiency data summarized in Table 5, show the number of SLP instructional trials, errors, and percentage of errors through the group criterion for individual students. The total number of instructional trials necessary to teach eight words to Tommy was 168 and 192 to Chris. Delbert learned six words in a total of 96 instructional trials and Carrie was taught four words in the group instructional arrangement in 88 instructional trials. For Tommy the total number of errors while learning to read eight words was two (percentage of errors 1.2%). Chris was taught eight words while making nine errors (4.7%). Delbert learned to read six target words with one error (1.0%) and Carrie learned four words with 16 errors (18.2%). Although Carrie made the greatest number of errors during instruction on Set 3 (6) and Set 4 words (10), her errors decreased after learning to use the procedure; the total number of errors made in the unsuccessful instruction on Set 1 words using the SLP procedure was 34.

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Insert Table 5 about here

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Incidental learning

In the pretests that occurred prior to each instructional condition, correct responding on each of the classification tests was zero across all students and target words. Data shown in Table 6 indicate the percentage of net gain for each student following completion of the final instructional condition. Results from the posttest show that the students were able to classify some, but not all, of the target words according to both the approximate cost of the item (mean=70%, range=50%-100%) and at what meal the food was normally consumed (mean=81%, range=62%-100%). There were no differences in the percentages of net gain between posttests immediately following training and the final posttest. A Chi-square test with an obtained score of .05 and a tabled value of 5.99 ($p < .05$), showed no significant correlation between the number of exposures to the incidental information in the prompt hierarchy and correct classification of the words.

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Insert Table 6 about here

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Generalization

Prior to instruction, the percentage of correct responding on the generalization tests, receptive identification of the target words and matching the written stimulus to a photograph of the referent, was 25% or less across students and target words. In the posttests following instruction, student performance was 100% across all words for both the receptive identification and matching tests. Each student maintained 100% correct responding on these tests in the final assessment. In addition, the data were analyzed to determine if the incidental information learned from prompts in the SLP hierarchy (i.e., classification of the words by cost and meal information) was also learned for the photographs. Prior to beginning the investigation, each student could expressively and receptively identify the photograph representing the target word. However, the percentage of correct classification of the photographs by both the cost and meal incidental information was at zero across students and photographs. In the final posttest, the mean percentage of net gain across the students and eight target words for classification of the photographs by cost information was 68% (range=50%-100%) and by meal information 76% (range=54%-100%).

Before beginning instruction, students also were asked to read the target food words from the actual restaurant menu, and expressively label the approximate cost and at what meal this food was normally consumed. The percentage of correct responding for each of these tests was also at zero before instruction. Following completion of the investigation, the mean percentage of correct reading of the words was 90.6% (range=75%-100%), identification of the cost 65.6% (range=37.5%-100%), and identification of the meal 75% (range=50%-100%).

Discussion

The purpose of this investigation was to evaluate the effectiveness of the SLP procedure in a small group instructional arrangement and to assess whether students could acquire incidental information placed in the SLP prompt hierarchy. Based on the findings of this study, four statements can be made.

First, the SLP procedure in the small group arrangement was effective in teaching two students with moderate mental retardation to read eight words, one student to read six words and Carrie to read four words found on a local restaurant menu. The procedural modifications made for Carrie were only needed in the initial instructional condition. The criterion level performance established with the SLP procedure during group instruction, maintained in subsequent probe conditions and extends information about the effectiveness of SLP from one-to-one teaching arrangements (Doyle et al., 1988).

Second, teachers may increase the efficiency of response prompting procedures through the systematic presentation of incidental information. Incidental learning (Stevenson, 1972) occurs when a student observes and performs behaviors not targeted for instruction. For example, Becker and Glidden (1970) taught a motor task, modelled by peers, to a group of males with mild mental retardation. While simply observing the peers performance of the target behaviors, students learned the target task (i.e. observational learning). In addition, students acquired social skills emitted by the peers during instruction (i.e., incidental learning). Although the acquisition of these social skills was not specifically programmed in their investigation, it may be possible for teachers to facilitate incidental learning through the planned delivery of this information during instruction. Gast, Doyle, Wolery, Ault, and Baklarz (1989) used a constant time delay procedure to teach a group of students with mild handicaps to read sight words. In this investigation, the correct spelling of a word was modelled by the teacher in the antecedent event (as part of the attending cue) or in the consequent event (paired with the descriptive statements following correct and incorrect responding). The results showed that while learning to read the target words, students also learned to spell some of the target words. In another small group investigation using the constant time delay procedure, Wolery, Cybriwsky, Gast, and Boyle-Gast (in press) taught four secondary-aged students with mild handicaps to identify local and national political offices, agencies, and over-the-counter medications. Incidental information about each target behavior was presented in the attending cue during instruction. The results indicated that presentation of this information not only facilitated the acquisition of the target behaviors, but also showed that students could learn some of the incidental information. Doyle et. al. (1990) taught these same target behaviors to four secondary-aged students with moderate mental retardation. In this investigation, the incidental information was presented in the descriptive praise statements following correct responses. The results from this study indicated that related but non-targeted information can also be acquired when presented in the consequent events following student responding. When using the system of least prompts procedure teachers might also facilitate incidental learning by embedding incidental information in the prompt hierarchy of the strategy. In this investigation, the consistent delivery of this information, paired with the target stimulus, resulted in (a) the systematic transfer of stimulus control from the prompts to the target stimulus and (b) students learning that the incidental cost and meal information was equivalent with the target word; that is, the students learned to classify the topographically dissimilar target words as members of the same stimulus class when the mediator (i.e., the cost or meal information) was presented in the prompt hierarchy. Future research should determine whether other types of related information such as rules or factual information can be learned in this way.

Third, the data seemed to indicate that when students learned to classify the target words according to the incidental information, they also learned to classify the photographs represented by the target words. The acquisition of the classification of the target words and photographs was anticipated based on the transfer mediational literature (Gast, Van Biervliet, & Spradlin, 1979; Sidman & Cresson, 1973; Sidman, Cresson, & Wilson-Morris, 1974). The ability of the teacher to present incidental information concurrent with direct teaching of the target task saved valuable instruction time, thus increasing classroom efficiency. Students also learned to expressively name and classify a few but not all of the target words found on the restaurant menu. Although the mean percentage of correct responding for the classification of the words on the menu (70.3%, range=43.7%-100%) was lower than for the word cards used during instruction (75.5%, range=58%-100%), this could have been due to the type of test used in measuring the students' classification responses in the generalization pre- and posttests. In the generalization tests, students were asked to expressively identify the cost and time of consumption (e.g., "When do we usually eat bacon?") as opposed to the receptive tests in the probe conditions (e.g., "Show me the foods we eat for breakfast.").

Fourth, in addition to finding no correlation between the total number of exposures to the incidental information and performance on the classification assessment, there are data to suggest that there was no relationship between the type of exposure and posttest classification performance. That is, students did not have to receive the incidental information on their own trials, rather they could rely on observation of other students' instructional trials which included delivery of the prompt information. For example, in the first instructional condition, Delbert was exposed to the cost prompt for the first word set a total of 49 times. However, he received no cost prompts during his own trials; that is, he responded with a correct unprompted response on his first instructional trial for each word from Word Set 1. This was followed by a 100% net gain in performance in classification of the first two words by the cost information. Because each student was learning the same target words and Delbert's first instructional trial for each of these words followed another student's trial, he used this opportunity to observe the other student, including delivery of the incidental information, and made the correct target response when it was his turn to respond. Subsequent research should evaluate this finding by teaching each student in the group different behaviors.

In summary, by definition of the SLP procedure, all prompts selected for use in the least-to-most hierarchy should provide the student with some clue as to the expected target response. Although the incidental information presented as prompts (i.e., the approximate cost and meal information) did not initially control the correct target response nor were students able to classify the target words according to this information, each prompt eventually acquired stimulus control over the target response and students learned to use this information to classify some of the target words. Therefore, it may be reasonable for teachers to design SLP instruction so that the beginning or intermediate prompt levels in the hierarchy consist of unknown information or information not at criterion levels.

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Table 1

Description of Students.

Name Gender	C.A.	Test	Score Diagnosis	Functioning Level
Tommy M	9yr 9mo	Stanford Binet	Full Scale IQ 42; MA 3-8; Down Syndrome;	Locates #1-7 on calculator; expressively ident. penny, nickel, quarter; counts 3 items; reads color and early survival words; can complete parts of total task chain of cleaning up after meals.
Chris M	8yr 6mo	Wechsler Intelligence Scale for Children-R; Vineland;	Full Scale IQ 40; Composite Score 1-7;	Identifies (10) upper, (5) lower case letters; reads (5) survival words; identify # of items in sets to 7; expressively identifies actions in pictures.
Delbert M	8yr 4mo	Wechsler Preschool & Primary Scale of Intelligence	Full Scale IQ 46;	Counts 12 items; sequences # 1-6; identifies (6) upper and lower case letters; reads (1) color and (2) survival words; prints first name.
Carrie F	7yr 1mo	Hiskey Nebraska Test of Learning Aptitude	Deviation IQ 60; MA 3-6; Down Syndrome;	Matches sequences of objects or symbols; identifies #1-11; identifies 7 color words and early survival signs, concept of one and all; traces name.

Table 2

Target Stimuli, Incidental Information, and the Order of Instruction Across Students.

Word Set	Target Stimuli	Incidental Information Prompt 1	Prompt 2
1	Bacon	"It costs less than a dollar."	"We eat it for breakfast."
	Chicken	"It costs more than a dollar."	"We eat it for dinner."
2	Eggs	"It costs less than a dollar."	"We eat it for breakfast."
	Soup	"It costs more than a aollar."	"We eat it for dinner."
3	Toast	"It costs less than a dollar."	"We eat it for breakfast."
	Hamburger	"It costs more than a dollar."	"We eat it for dinner."
4	Pancakes	"It costs less than a dollar."	"We eat it for breakfast."
	Spaghetti	"It costs more than a dollar."	"We eat it for dinner."

Table 3

Description of Assessment Measures and Order in Which They Occurred.

Measure: TYPE Description Selection Criteria	Word Set	Pre-Test	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Post-Test
Expressive: TARGET								
Oral identification	1	x	x	x	x	x	x	x
of written word on card	2	x	x	x	x	x	x	x
and menu; ("What word?")	3	x	x	x	x	x	x	x
0% across students	4	x	x	x	x	x	x	x
Receptive: GENERALIZATION								
Point identification	1	x	x	x				x
of written word;	2	x		x	x			x
("Give me ____.")	3	x			x	x		x
25% or < across students	4	x				x	x	x
Comprehension: GENERALIZATION								
Match written word to	1	x	x	x				x
picture/referent of	2	x		x	x			x
the word; ("Find same.")	3	x			x	x		x
25% or < across students	4	x				x	x	x
Receptive: GENERALIZATION								
Point identification	1	x	x	x				x
din/break (pictures);	2	x		x	x			x
("Give me din/break.")	3	x			x	x		x
record the % correct	4	x				x	x	x
Receptive: GENERALIZATION								
Point identification	1	x	x	x				x
of cost (pictures);	2	x		x	x			x
("Give me > or < $?")	3	x			x	x		x
record the % correct	4	x				x	x	x
Receptive: CLASSIFICATION								
Point identification	1	x	x	x				x
of din/break (words);	2	x		x	x			x
("Give me din/break.")	3	x			x	x		x
record the % correct	4	x				x	x	x
Receptive: CLASSIFICATION								
Point identification	1	x	x	x				x
of cost (words);	2	x		x	x			x
("Give me > or < $?")	3	x			x	x		x
record the % correct	4	x				x	x	x

Table 4

The Number and Type of Prompts Delivered Across Students for Each Instructional Condition.

Word Set	Target Word	Prompt 1 Cost	Incidental Information Prompt 2 Meal	Prompt 3 Picture	Prompt 4 Model
1	bacon	20	16	14	0
	chicken	29	24	19	1
	Total	49	40	33	1
2	eggs	8	2	2	0
	soup	4	2	2	1
	Total	12	4	4	1
3	toast	12	11	7	4
	hamburgers	3	2	2	1
	Total	15	13	9	5
4	pancakes	16	16	8	1
	spaghetti	14	14	11	1
	Total	30	30	19	2

Table 5

The Number of Individual Trials and Errors, and the Percent of Errors Through Criterion, For All Students and Each Instructional Condition.

Word Set	Student	Efficiency Variable: Number of Trials	Number of Errors	Percent of Errors
Set 1	Tommy	48	0	0%
Set 2	Tommy	28	1	3.5%
Set 3	Tommy	32	0	0%
Set 4	Tommy	60	1	1.7%
Set 1	Chris	52	2	3.8%
Set 2	Chris	36	2	5.6%
Set 3	Chris	44	0	0%
Set 4	Chris	60	5	8.3%
Set 1	[a] Delbert	40	0	0%
Set 2	Delbert	28	0	0%
Set 3	Delbert	28	1	3.6%
Set 3	[b] Carrie	44	6	13.6%
Set 4	Carrie	44	10	22.7%
	Total Across Instructional Conditions and Students			
Set 1	3 students	140	2	1.4%
Set 2	3 students	92	3	3.2%
Set 3	4 students	148	7	4.7%
Set 4	3 students	164	22	13.4%
Total		544	34	6.2%

[a] Delbert was placed into a new classroom following Probe IV.
[b] Carrie did not reach criterion level responding in the small group instructional format with SLP on Set 1 words and she did not receive instruction on Set 2 words.

Table 6

The Percentage of Net Gain in Correct Classification of Target Words by Incidental Information Presented in the Prompt Hierarchy for Each Student.

Student	Word Set	Incidental Information Prompt 1/Cost	Incidental Information Prompt 2/Meal
Tommy	1	75%	100%
	2	50%	100%
	3	50%	100%
	4	0%	0%
Chris	1	100%	100%
	2	100%	100%
	3	100%	100%
	4	0%	12.5%
Delbert	1	100%	100%
	2	100%	100%
	3	100%	100%
Carrie	1	100%	100%
	2	0%	12.5%
	3	37.5%	87.5%
	4	25%	0%

Figure Captions

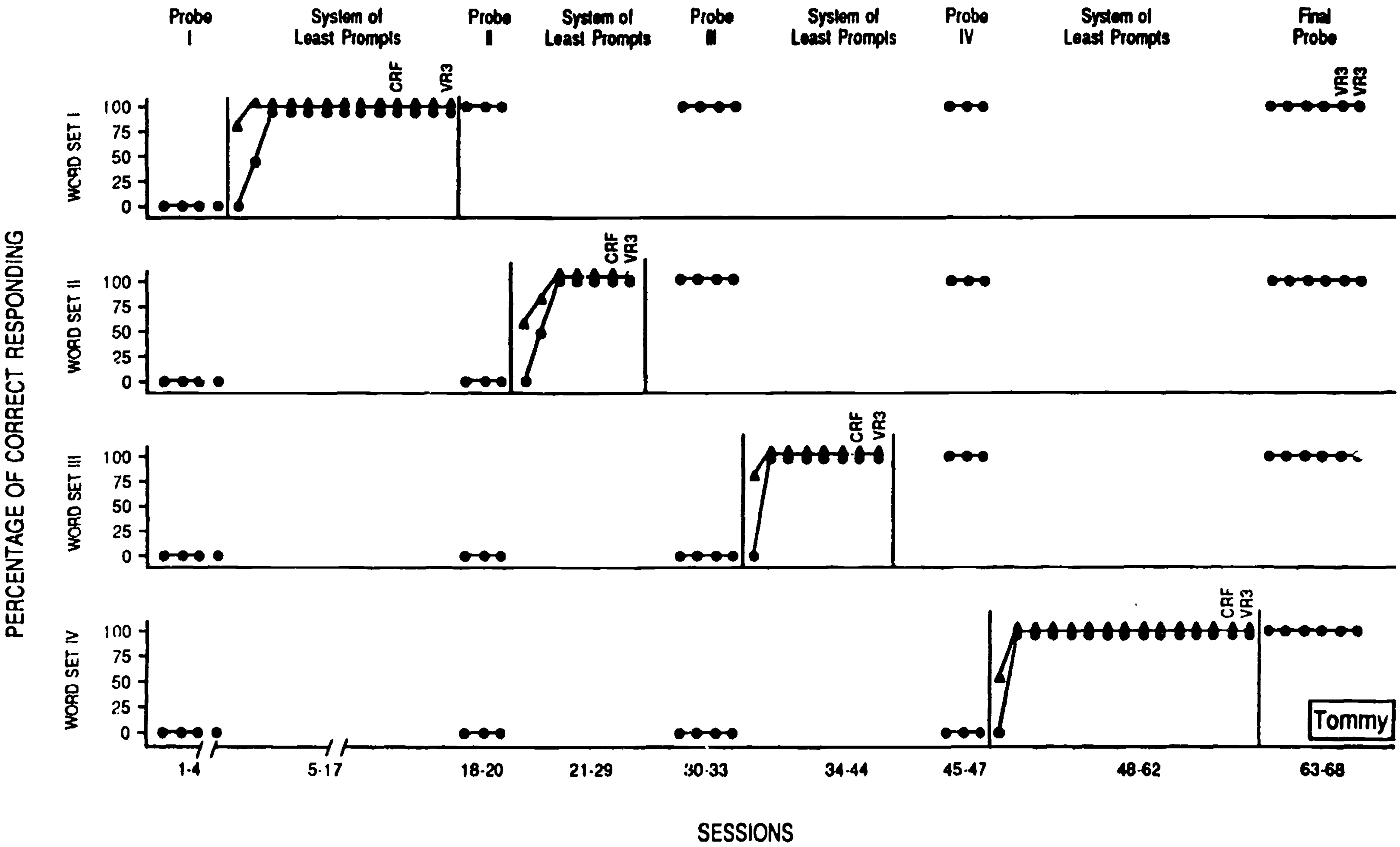
Figure 1. Instructional effectiveness for Tommy: Percentage of correct responding during the probe conditions and daily probe trials are represented by the closed circles. The percentage of unprompted correct responding during system of least prompts instructional conditions are represented by the open triangles.

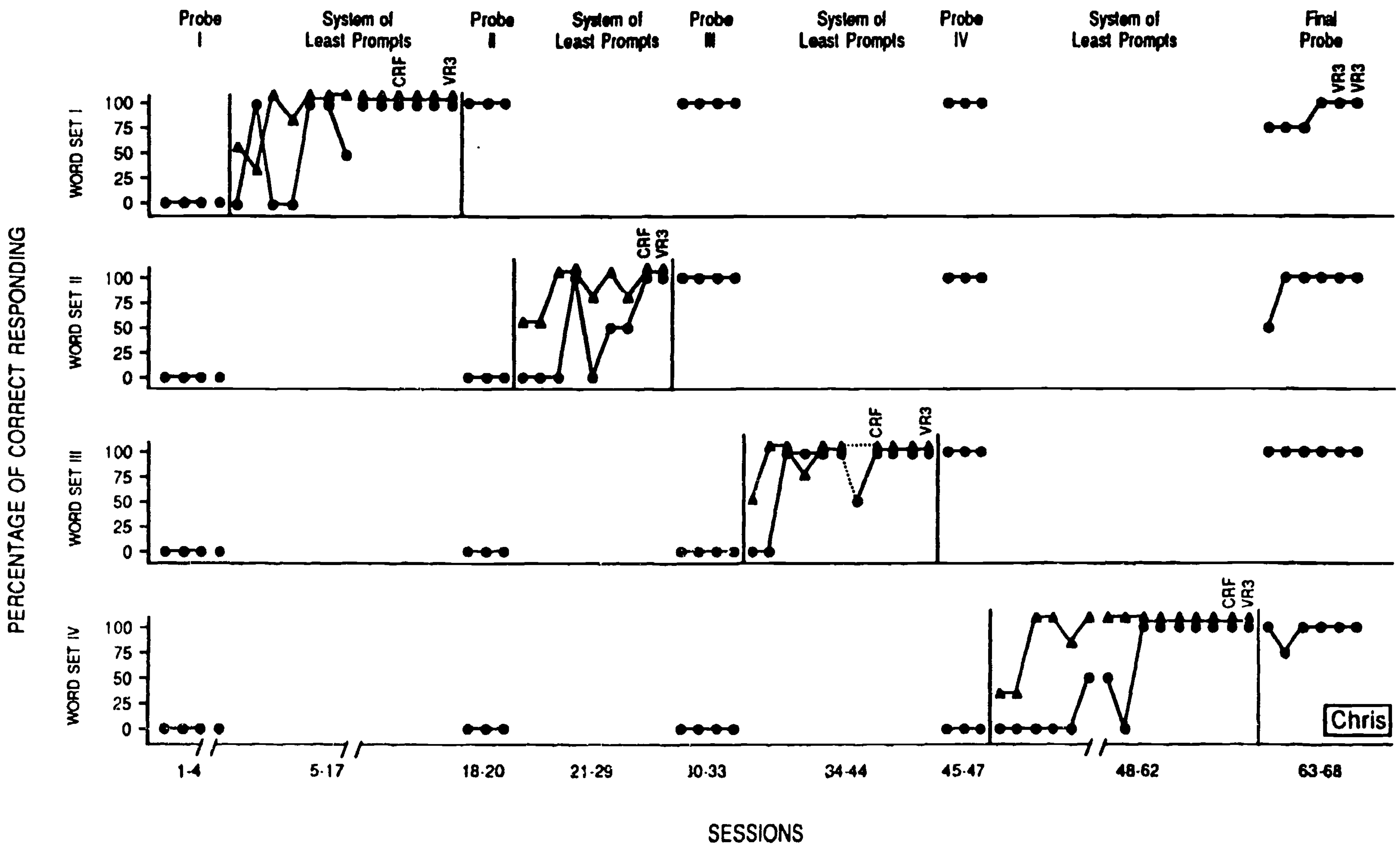
Figure 2. Instructional effectiveness for Chris: Percentage of correct responding during the probe conditions and daily probe trials are represented by the closed circles. The percentage of unprompted correct responding during system of least prompts instructional conditions are represented by the open triangles.

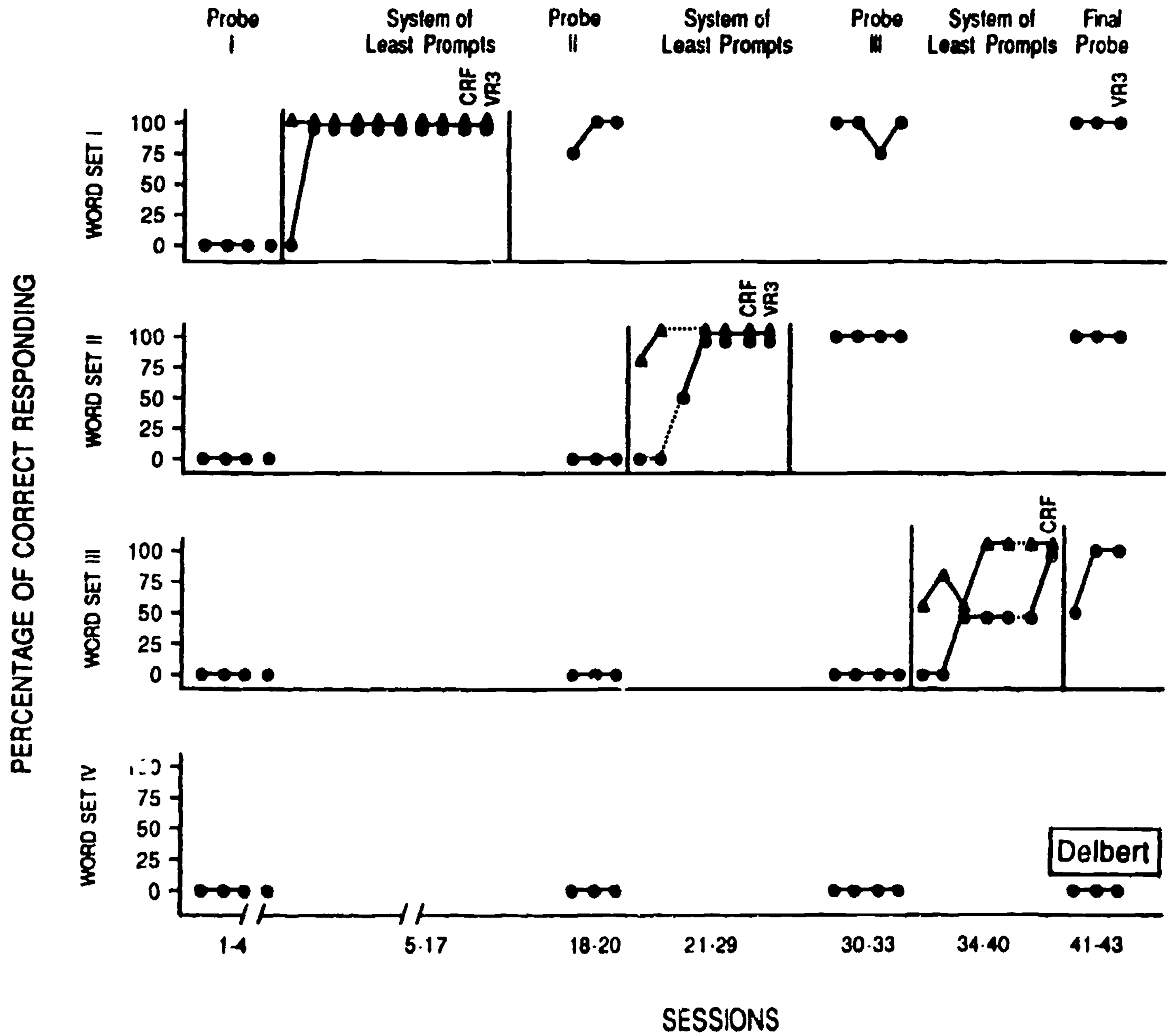
Figure 3. Instructional effectiveness for Delbert: Percentage of correct responding during the probe conditions and daily probe trials are represented by the closed circles. The percentage of unprompted correct responding during system of least prompts instructional conditions are represented by the open triangles.

Figure 4. Instructional effectiveness for Carrie: Percentage of correct responding during the probe conditions and daily probe trials are represented by the closed circles. The percentage of unprompted correct responding during system of least prompts instructional conditions are represented by the open triangles. The percentage of unprompted correct responding during the one-to-one supplemental system of least prompts sessions from the first instructional condition are represented by closed triangles.

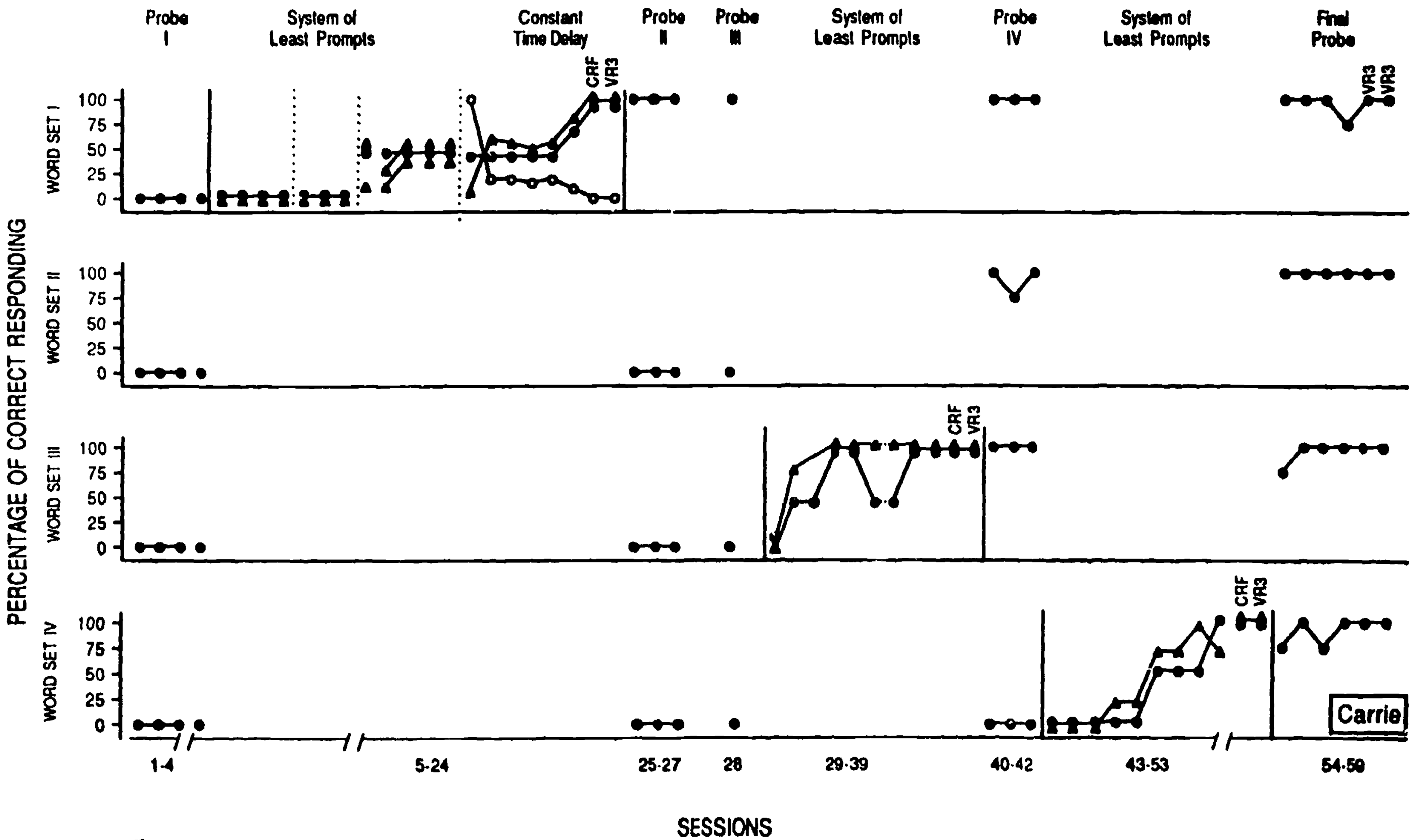
The percentage of unprompted and prompted correct responding in the constant time delay sessions are represented by open triangles and circles, respectively.


Probe I
System of Least Prompts
Probe II
System of Least Prompts
Probe III
System of Least Prompts
Probe IV
System of Least Prompts
Final Probe
CRF
VR3
WORD SET I
WORD SET II
WORD SET III
WORD SET IV
100
75
50
25
0
PERCENTAGE OF CORRECT RESPONDING
1-4
5-17
18-20
21-29
30-33
34-44
45-47
48-62
63-68
SESSIONS
Tommy


Probe I
System of Least Prompts
Probe II
System of Least Prompts
Probe III
System of Least Prompts
Probe IV
System of Least Prompts
Final Probe
CRF
VR3
PERCENTAGE OF CORRECT RESPONDING
WORD SET I
WORD SET II
WORD SET III
WORD SET IV
100
75
50
25
0
1-4
5-17
18-20
21-29
30-33
34-44
45-47
48-62
63-68
SESSIONS
Chris



Probe I
System of Least Prompts
Probe II
System of Least Prompts
Probe III
System of Least Prompts
Final Probe
CRF
VR3
CRF
VR3
CRF
VR3
PERCENTAGE OF CORRECT RESPONDING
WORD SET I
WORD SET II
WORD SET III
WORD SET IV
100
75
50
25
0
Delbert
1-4
5-17
18-20
21-29
30-33
34-40
41-43
SESSIONS


Probe I
System of Least Prompts
Constant Time Delay
Probe II
Probe III
System of Least Prompts
Probe IV
System of Least Prompts
Final Probe
CRF
VR3
PERCENTAGE OF CORRECT RESPONDING
WORD SET I
WORD SET II
WORD SET III
WORD SET IV
100
75
50
25
0
Carrie
1-4
5-24
25-27
28
29-39
40-42
43-53
54-59
SESSIONS

355

358

Appendix L

Gast, D. L., Doyle, P. M., Wolery, M., Ault, M. J., & Baklarz, J. L. (1990). Acquisition of incidental information presented in consequent events. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

MAUSCRIPT NOT COMPLETED

Acquisition of Incidental Information Presented in Consequent Events[1]

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Running Head: Incidental Information

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Abstract

This investigation examined the effects of presenting incidental information in the consequent events following student responses to target stimuli. Four primary-aged students from a classroom for students with multiple handicaps were taught to name photographs of buildings and places of interest in the local community using a constant time delay procedure. In addition, the students' acquisition of incidental information related to each of the photographs was assessed. The incidental stimuli included the street address and/or an activity conducted at the building or place. During instructional conditions, the teacher presented the incidental stimuli as part of the consequent event following a student's response. A multiple probe design was used to assess experimental control of acquisition of both target and incidental stimuli. The results indicated that: (a) three students learned to name 12 photographs and one student learned to name three photographs; (b) presentation of incidental stimuli in the consequent events resulted in three students acquiring some of the non-targeted incidental information; and (c) the type and amount of incidental stimuli learned was consistent across participants and instructional conditions. These findings are discussed in terms of designing efficient instruction for students with disabilities.

Acquisition of Incidental Information Presented in Consequent Events

The need for the design and implementation of effective and efficient instruction in classrooms for students with handicaps is well documented in the literature (Wolery, Bailey, & Sugai, 1988). Although not required by law to produce results once the requirements of the law are met (Turnbull, 1990), we as educators should still be accountable for the effects of our instructional efforts (Wolery & Gast, 1990). To accomplish this, a teacher operationalizes the "best" practices for assessment, management of student behavior, monitoring of student performance, management of instruction time, and selection of the most appropriate behaviors to be trained. In addition, he or she must select the "best" procedure to teach new behaviors. The literature shows that many different strategies are effective; that is, learning has occurred when these procedures were used to teach a variety behaviors to a wide range of students with handicapping conditions. Although any one of a number of procedures including stimulus shaping ( ), the system of least prompts (Doyle, Wolery, Ault, & Gast, 1988), most-to-least prompting ( ), error correction ( ), and time delay (Handen & Zane, 1988) might result in the student acquiring behaviors targeted for instruction, further evaluation is needed before selecting the "best" strategy.

One way in which this can be done is to examine the efficiency of a particular procedure (Wolery & Gast, 1990). Typical measures of efficiency include the rapidity of acquisition (e.g., the number of trials or sessions to criterion), the errorlessness of learning (e.g., the number or percentage of errors to criterion), or the savings in teacher time (e.g., number of minutes of direct instruction). An analysis of the efficiency of a procedure based on these measures can only be accomplished through the comparison of one procedure to another. Ault, Wolery, Doyle, and Gast (1989) summarized investigations that compared one effective procedure to another and each study reported at least one of these typical measures of efficiency. When using typical measures to evaluate procedures, one stategy is said to be "more efficient" than another if it results in the same amount of learning but with less effort by the student (Wolery & Gast, 1990). Although valuable factors to consider when selecting an instructional strategy, other measures of efficiency can be examined. One such measure, termed broad learning by Wolery and Gast (1990), is the acquisition of behaviors not targeted for direct instruction.

Broad learning can be broken down into two types of learning; observational and incidental. Observational learning is the acquisition of behaviors for which other students are receiving direct instruction, although the observer has received no direct instruction or programmed consequences for responding (Bandura, 1971). Incidental learning refers to the acquisition of non-target behaviors present during instruction for which there is no direct instruction and no programmed consequences for responding (Stevenson, 1972). Although observational learning typically occurs in small group instructional arrangements when students are learning different behaviors, incidental learning can occur in small group or one-to-one arrangements. In terms of evaluating a procedure based on broad learning, student responses to incidental and observational stimuli are assessed prior to and following instruction on the target behaviors. With each type of broad learning, the acquisition of the non-target behaviors would result in more efficient instruction; that is, the student learns additional information with little effort by the teacher. Observational learning has been measured in a variety of investigations ( ). However, there is a paucity of research in even simple demonstrations of the acquisition of incidental behaviors during instruction with effective procedures (Doyle, Gast, Wolery, Ault, & Wiley, 1990).

A few investigations have demonstrated that incidental learning can be facilitated through the systematic presentation of stimuli not targeted for instruction somewhere in the trial sequences of constant time delay, progressive time delay, and the system of least prompts. For example, Alig-Cybriwsky, Wolery, & Gast (1990) and Wolery, Ault, Gast, Doyle, & Mills (1990) taught sight words to students using constant time delay while presenting the correct spelling of the targeted stimuli as part of the attending cue. Other investigations taught students the target behaviors with the constant time delay procedure while presenting the incidental stimuli in the consequent events (Gast, Wolery, Morris, Doyle, & Meyer, 1990; Wise, 1989). Results showed that the in each investigation, students were able to learn some of the incidental stimuli. In addition, students have acquired incidental stimuli when presented in the progressive time delay trial sequence (Stinson, Gast, Wolery, & Collins, 1987). When the system of least prompts procedure has been used to train target behaviors, students have acquired incidental stimuli presented in the prompt hierarchy (Doyle, Gast, Wolery, Ault, & Meyer, 1989) and in the consequent events following student responses (Gast, Doyle, Wolery, Ault, & Farmer, in press).

Although these investigations have demonstrated that students can acquire some incidental information, additional research is needed to determine if students can acquire multiple numbers or types of stimuli with a variety of procedures. Keel and Gast (in press) and Shelton, Gast, Wolery, and Winterling presented two types of information when using constant time delay to teach sight words to students with mild delays. In each investigation, correct spelling of the word was presented in the attending cue and the definition of the target word was delivered in the consequent events following correct student responses. Results showed that in both studies students learned fewer spellings than definitions.

In order to add to existing research that demonstrates teacher selection of "best" instructional procedures should be based on not only the effectiveness and efficiency as assessed by typical measures, but also in terms of broad learning, the purpose of this investigation was two-fold. First, could students learn two incidental stimuli when these stimuli were presented in the consequent events following all student responses and second, could students acquire two different types of incidental stimuli when presented in the consequent events of the constant times delay trial sequence?

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Methods

Participants and Setting

Four males with mild mental retardation, ranging in age from 8 years 10 months to 9 years 8 months, from a public school classroom for students with multiple handicaps, participated in the study. Parental permission was obtained prior to the investigation. All participants exhibited the following entry skills: (a) intact auditory and visual systems (students consistently responded to auditory and visual stimuli with corrective appliances when necessary); (b) appropriate attending behaviors in a group (students sat and made eye contact with the teacher and materials for 20 minutes within the small group arrangement); (c) previous history with the constant time delay procedure (students waited up to 4 sec for a prompt and orally imitated an expressive teacher model); and (d) ability to state incidental information related to at least two known non-target photographs of local places or buildings. In addition, to continue in the study following instruction on the first set of photographs, students were required to demonstrate that they had learned a minimum of one piece of incidental information about each target stimulus. A more detailed description of the four students is presented in Table 1.

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Insert Table 1 about here

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Instructional and probe sessions were conducted by the classroom teacher in the students' (6.4 m x 8.9 m) classroom. All students were seated together at a (2.0 m x 1.0 m) rectangular table located in the back of the classroom. The teacher and students were arranged so that all word cards were visible and all student responses were audible to each member in the group. Students not involved in the study participated in regular classroom activities with the instructional assistant.

Materials

Twelve photographs of local places of interest were selected as target stimuli. Each 35 mm target photograph was taped to a 10 cm x 15 cm white index card. The back of each photograph contained written instructions for the teacher; that is, the type of incidental information to be delivered and the order for presenting the incidental stimuli. Reinforcers included a variety of small candies (Snickers, M & M's, Skittles, etc.) Target photographs, the order of instruction, and the incidental stimuli are presented in Table 2.

Insert Table 2 about here

Experimental Design

A multiple probe design (Tawney & Gast, 1984) across four sets of three photographs and replicated across students was used to evaluate the effectiveness of constant time delay and presentation of incidental stimuli in the consequent events following student responding. Initially, individual pretests occurred to assess students' ability to name the 12 targeted photographs and to measure familiarity with the incidental information presented with each of the photographs. Following the pretests, experimental conditions were implemented in this order: (a) probe all target photographs in individual sessions and assess knowledge of the incidental stimuli to be presented with the first set of photographs (Photo Set 1); (b) teach Photo Set 1 with constant time delay in a small group instructional arrangement until all students reach criterion level responding and conduct daily individual probe trials on these stimuli; and (c) probe all target photographs and assess acquisition of the incidental stimuli presented with Photo Set 1 and the stimuli to be presented with Photo Set 2. This sequence of conditions was repeated until all four sets of photographs had been taught.

Assessment Conditions

Pretests and posttests. A research associate used a number of measures to select the target photographs and assess students' acquisition of incidental stimuli prior to Probe 1, following each instructional condition, and following the Final Probe. Descriptions of the tests, the times of assessment, and criteria for selecting target photographs are shown in Table 3. All student responses during test sessions were followed by the instructor waiting a 3-5-sec intertrial interval and presenting the next trial. Prior to beginning a test session, students selected a prize that was delivered non-contingent of performance following completion of the session.

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Insert Table 3 about here

- - - - - - - - - - - - - - - -

Probe conditions. Prior to instruction on each set of photographs, students were assessed in three individual probe sessions on their ability to name the 12 photographs. Each student received a total of 24 trials per session (two trials on each of the 12 target photographs). All probe trials consisted of the teacher placing a photograph on the table in front of a student, presenting the attending cue ("S, look here."), ensuring the attending response, delivering the task direction ("What is this?"), and providing a 4-sec response interval. All student responses during probe conditions were followed by the teacher waiting the 3-5-sec intertrial interval and presenting the next trial. Following individual probe sessions, each student received the prize selected prior to beginning the session, non-contingent of performance.

Daily probe trials. Daily probe trials were conducted to assess whether a student's correct naming of a target photograph in the group instructional arrangement was a function of having learned the photograph or a result of imitating other students' models of the correct response. The daily probe trials were identical to trials conducted in the probe conditions. The teacher approached an individual student and conducted one trial on each of the three target photographs currently receiving instruction. When the three individual probe trials were completed, the teacher told the student to go to the table for instruction. This continued until all students were seated at the table.

Instructional Procedures

General procedures and group arrangements. The 12 target photographs were divided into four sets; each set consisting of three photographs. Each set was taught in a small group instructional arrangement using a 0-4-sec constant time delay procedure. All students were taught the same set of target photographs. As shown in Table 2, one or two incidental stimuli were assigned to each photograph: (a) a street address for each target photograph in Photo Set 1; (b) the street address and an activity for Photo Set 2; (c) two activities were presented for each target photograph in Photo Set 3; and (d) Photo Set 4 replicated the second instructional condition with delivery of the street name followed by an activity.

The target photographs were randomly presented within each instructional session with six trials presented to each of the students; two trials on each of the three target photographs across students. A student did not receive more than two consecutive turns and no photograph was presented on more than two successive trials. Instruction continued until all students reached criterion level responding on each photograph in a set. That is, three sessions of 100% correct responding to the task direction alone by all students on the three daily unreinforced probe trials as well as 100% correct responding during group instructional sessions; one session using a continuous schedule of reinforcement (CRF), and two sessions with approximately every third correct response receiving descriptive verbal praise (VR3). If an individual student reached criterion before other members of the group, that student remained in the small group arrangement and received instructional trials as usual

Constant time delay. A constant time delay procedure with a 4-sec delay interval was used to teach all photographs to criterion. A vocal model naming the target photograph was the controlling prompt. Prior to instructional sessions, the students selected a prize to be delivered non-contingent of performance at the end of the session. The initial instructional session for each set was conducted using a 0-sec delay interval. Each 0-sec instructional trial consisted of the teacher securing the attention of a student by calling his name, presenting the task direction (i.e., "What is this?"), and modeling the correct response (e.g. "Commonwealth Stadium."). Following the first instructional session, the delay interval was increased to 4 sec and remained there through all subsequent sessions.

Incidental stimuli. Correct responses which occurred before delivery of the prompt (unprompted corrects) or following the teacher's model (prompted corrects) were reinforced with descriptive verbal praise and confirmation of the correct response (e.g., "Good, that is Commonwealth Stadium."). In addition, the teacher delivered one or two incidental stimuli (the address and/or activity) related to the photograph (i.e., "It is on Alumni Drive and we watch football there."). Only unprompted correct responses counted toward criterion. If the student made an incorrect response before the prompt (unprompted error) or after the teacher's model (prompted error), the teacher said "Wrong.", delivered the correct response (e.g, "This is Commonwealth Stadium."), and stated the incidental information (i.e., "It is on Alumni Drive and we watch football there."). If the student did not respond following delivery of the model (no response), the teacher waited a 3-5 sec intertrial interval and presented the next trial.

Review Trials. Beginning with instruction on the second set of target photographs, each student received one review trial on a previously learned photograph to monitor maintenance of learned target items. Review trials occurred after all students were seated at the table. The trial sequence was identical to that used during 4-sec- delay instructional trials.

Reliability

Dependent measure reliability estimates. Reliability assessments were conducted by a research associate twice weekly, and at least once during each experimental condition for each student. A point-by-point method (number of agreements divided by number of agreements plus disagreements multiplied by 100) was used to calculate inter-observer agreement percentages.

Independent measure reliability estimates. The teacher's fidelity with the experimental procedures outlined for both probe and small group constant time delay instructional sessions also was assessed (Billingsley, White, & Munson, 1980). These measures included recording total session time, presenting the correct target photograph, delivering the attending cue, ensuring an attending response, presenting the task direction, waiting the specified response interval, delivering the prompt, delivering correct consequent events, and waiting the specified intertrial interval. The teacher's behavior was observed and compared to a description of the experimental strategies. Procedural reliability estimates were calculated by dividing the number of actual teacher behaviors by the number of planned behaviors and multiplying by 100. Estimates were calculated for each condition, on each of the above behaviors, for each student in the group.

Results

Reliability

Interobserver reliability assessment on student responding and the teacher's execution of the written descriptions of the procedures occurred in 36% of the probe sessions and in 53% of the instructional sessions. The mean percentage of agreement on student responding during probe and instructional conditions was 100% across all students in the group. In the probe conditions, the mean percentage of agreement on procedural reliability was 100% on all behaviors. In constant time delay conditions, the mean percentage of agreement was 100% on all independent measures except delivery of the appropriate consequent event (mean=99.1%, range=94.0%-100%) and recording the duration of instructional sessions; the teacher recorded the total session length in 90% of the instructional sessions.

Effectiveness

The mean percentages of correct responding to the target photographs for Jay, Vance, Chad, and Darrel during instructional and probe conditions, and the order in which the photo sets were introduced are shown in Figures 1, 2, 3, and 4, respectively.

Insert Figures 1, 2, 3, and 4 about here

During the initial probe condition, the percentage of correct responding to target photographs was zero across all photo sets and participants. The use of a constant time delay instructional procedure in a small group arrangement was effective in establishing criterion level responding for Photo Set 1 across the four students. In the second probe condition, performance maintained at 100% on photographs from Set 1 across all probe sessions and participants. Although Darrel was taught to name the first set of target photographs, he did not acquire the incidental stimuli and was not a member of the group during subsequent instructional conditions.

For Jay, Vance, and Chad, the percentage of correct responding to untrained target photographs from Photo Sets 2, 3, and 4 remained at zero until the constant time delay procedure was implemented in instructional conditions. The procedure was effective in establishing criterion level performance for the three remaining sets of target stimuli for Jay, Vance, and Chad. In the final probe condition, criterion level responding to the 12 target photographs maintained for Jay and Vance across four probe sessions. Chad responded at 100% in the last three sessions of the final probe.

Efficiency

Efficiency data included the total number of instructional sessions, errors, the percentage of errors, and amount of direct instructional time across students through the group criterion. The total number of sessions for the four students through the group criterion on Photo Set 1 was nine. In the next three instructional conditions where three students were taught to name a total of nine photographs, the total number of sessions was 31; 15 sessions for Set 2, 10 for Set 3, and 6 for Set 4. The use of the constant time delay procedure in a small group instructional arrangement was near errorless in establishing criterion level responding. The total number and percentage of errors made by four participants on Photo Set 1 was eight (3.8%), although Darrel made six of these unprompted errors. In the next three instructional conditions, Jay, Vance, and Chad only made a total of three unprompted errors (.5%); one error (.4%) in Set 2, two errors (1.1%) in Set 3, and zero errors in Set 4. The number of minutes necessary to teach Photo Set 1 to four students was 47. The total number of minutes of direct instructional time through the group criterion across Photo Sets 2, 3, and 4 was 136: 67, 45, and 24, respectively.

Incidental Learning

The mean percentages of correct responding to incidental stimuli prior to and following instruction for Jay, Vance, and Chad are presented in Table 4. In the tests that occurred prior to each instructional condition, (i.e., participants were asked to name the incidental stimulus when shown the photograph), the percentage of correct responding was zero for all participants. During instruction on Photo Set 1, the teacher delivered one incidental stimulus (i.e., the address) per target photograph. Following instruction, the mean percent of correct naming of the address was 100% for Jay, Vance, and Chad; Darrel did not acquire the address for any of the target photographs. While training Photo Set 2, two unlike incidental stimuli (i.e., one address and one activity) were presented for each target photograph in the consequent events. As measured in the probe condition following instruction, Jay, Vance, and Chad only learned to identify the activity. Therefore, while teaching Photo Set 3, two similar incidental stimuli (i.e., two activities) were presented. This resulted in each of the students acquiring two pieces of like stimuli for each target photograph. The fourth instructional condition replicated training of Photo Set 2; two unlike indidental stimuli were delivered. Following instruction, the results were identical to Photo Set 2; that is, participants learned the activity related to each Set 4 photograph, but not the address.

Insert Table 4 about here

Generalization

In the final posttest, participants were told a street address or an activity and asked to name the target place corresponding to the incidental stimulus. The results were identical to the percentages of correct responding to incidental stimuli in the probe conditions. Jay, Vance, and Chad were able to name the target places taught in the first instructional condition when given the address. The percentage of correct naming of the target places when presented with the address from Sets 2, 3, and 4 remained at zero across participants. The percentage of correct naming of the target place when presented with an activity was 100% across target photographs and participants.

Following completion of the investigation, participants also were asked on one trial to receptively identify a target place when the teacher named the address. The participant was presented with six photographs of local places of interest. The teacher named the address and asked the student to point to the correct place. The mean percentage of correct responding on this test maintained at 100% for photographs from Photo Set 1. However, the percentage of correct responding to the incidental address stimuli increased for two of the three participants in Sets 2 and 4. Chad pointed to one of the photographs from Set 2 (33%) and two of the photographs from Set 4 (66%) when the teacher named the address. Vance pointed to one photograph from Set 2 (33%) and one photograph from Set 4 (33) when presented with the street address.

Discussion

This investigation taught students to name photographs of local buildings and places of interest in a small group instructional arrangement using a constant time delay procedure. The places of interest were selected based on teacher recommendations that we target stimuli that could be integrated into future community-based training opportunities. Four statements can be made based on the findings of this investigation. First, the constant time delay procedure, along with the delivery of incidental stimuli, was reliably implemented in a small group instructional arrangement by the classroom teacher. Second, constant time delay was effective in teaching three students to name 12 target photographs, and one student to name three photographs of local places. Third, the combination of the instructional procedure and small group instruction resulted in rapid acquisition and near errorless learning of the target stimuli. Each target photograph required an average of only 19.5 trials and .28 errors per student through the group criterion. Although Photo Set 2 required more sessions through criterion than Photo Set 1, there were two extended school vacations during instruction on the second set of photographs which could have contributed to the total minutes of direct instructional time. In addition, the number of sessions (6) and errors (0) decreased by the fourth instructional condition as Jay, Vance, and Chad learned to use the procedures to acquire the target photographs.

Fourth, three of the students learned a minimum of one piece of incidental information about each target stimulus when presented in the consequent events following student responding. This replicates earlier investigations which placed incidental stimuli in the consequent events when teaching sight words (Doyle, Gast, Wolery, Ault, & Farmer, 1990; ....). An additional research question of this investigation was whether students could acquire two pieces of incidental information. Two investigations (Keel & Gast, in press; Shelton, Gast, Wolery, & Winterling, in press) taught sight words in small group arrangements. During each instructional condition, two types of incidental stimuli were presented; correct spelling of the target word in the antecedent portion of the trial sequence and the target word's definition in the consequent event following correct student responses. The results from each study showed that although students learned some of the spelling information, the percentages of net gain were greater for the word definitions presented in the consequent events. In this investigation, the three students demonstrated that it was possible to learn two pieces of incidental information. However, they only learned two pieces when similar stimuli were presented (i.e., two activities in training Photo Set 3). The students failed to acquire the street address of any of the target photographs when it was presented along with the activity in the consequent events during instruction of Photo Sets 2 and 4. Although they demonstrated that they could learn the address for each target photograph presented in the first instructional condition, the main activity of the target place was already "known" to each of the students as measured in the pretest. The results of these investigations might indicate that student acquisition of more than one piece of incidental information is dependent on (a) the similarity of the incidental stimuli (e.g., easier to learn two "like" pieces of information), and/or (b) ensuring that two or more incidental stimuli are of equal difficulty (e.g., the activity information was "easier to learn", had more "meaning" or was of greater "interest" to the students than the address).

In addition, during instruction on Photo Sets 2 and 4, the two dissimilar incidental stimuli were always delivered in the same order; that is, the teacher presented the address then the activity ("It is on Alumni Drive, and we watch football there."). Although the order of presentation did not effect the acquisition of two like types of stimuli in Photo Set 3, it could have affected learning when two or more unlike types were systematically delivered. If there had been time available for continuation of this investigation, other instructional conditions could have examined the effects of presenting (a) two addresses (e.g., target places located at intersections of major streets), or (b) one address and one activity (e.g., reverse the order of presentation) on the acquisition of incidental stimuli.

Future research should examine whether the acquisition of more than one piece of incidental information is dependent on the number, the similarity, the "relevance", or the order of delivery of the stimuli. Future investigations also should look at how these variables effect students with more severe handicapping conditions. Although not examined by this study, further questions could include how the incidental presentation of future target stimuli during current instruction effects future learning (Wolery, Doyle, Gast, Ault, Meyer, & Stinson, in press). For example, could these three students have acquired the street addresses presented during current instruction more efficiently (e.g., as measured by the number of trials, errors, or minutes of direct instruction time to criterion) than addresses of other known buildings or places of interest? The results of this investigation and others that have included the presentation of incidental stimuli, have practical implications for teachers and other classroom personnel. That is, the acquisition of information "incidental" to the targeted behaviors increases the efficiency of instruction in that the teacher is "getting something for nothing".

Table 1

Description of Students

Student Name	C.A. yr/mo	Test Name	Score Diagnosis	Functioning Level
Jay	9yr/2mo	Stanford-Binet intelligence scale	IQ 52; speech and language delayed	Reads 25 survival words; reads 1st grade passage and answers questions; given word, can identify short vowel and final sound; sums addition facts to 10; identify groups of coins to $1.00; writes words on large line paper; time to 5 min.
Vance	9yr/6mo	Wechsler Intelligence Scale for Children-R	IQ 75; speech and language delayed	Reads 1st grade Dolch words; reads 1st grade passage and answers questions; given word, can identify short vowel sound; copies lower case cursive letters; writes 5 words on small lined paper; sums and subtracts 1 digit numbers to 18.
Chad	8yr/8mo	Wechsler Intelligence Scale for Children-R	IQ 63; speech and language delayed; hearing impaired	Reads primer sight words; reads 1st grade passage and answers questions; given word, can identify short vowel, initial, and final sound; sums addition facts to 10; groups coins up to $1.00.
Darrel	8yr/6mo	Wechsler Intelligence Scale for Children-R	IQ 50; LD; speech and language delayed	Reads primer Dolch words; copies name; names and gives value of coins; can identify 20 items in set; given consonants, can say sounds; names numbers.

Table 2

Target Photographs, the Order of Instruction, and the Incidental Stimuli Across Students

Photo Set	Target Photograph	Incidental Address	Stimuli Activity
Set 1	Turfland Mall	Harrodsburg Rd.	N/A
	Good Samaritan Hospital	Maxwell St.	N/A
	Lexington Library	East Main St.	N/A
Set 2	Rupp Arena	West High St.	Watch Basketball Games
	Lexington Ice Center	Eureka Spring Dr.	Ice Skating
	Commonwealth Stadium	Alumni Dr.	Watch Football Games
Set 3	Living Arts and Science	N/A	Art and Science Class
	Humane Society	N/A	Buy Pets, Find Lost Pets
	Health Department	N/A	Free Medecine, Get Shots
Set 4	Y.M.C.A.	East High St.	Swimming
	Triangle Park	West Main St.	Look at Fountains
	Par 3	Mason-Headlee Rd.	Play Putt-Putt

Table 3

Description of Entry, Target, Incidental, and Generalization Tests and Order in Which They Occurred

Test Description Selection Criteria	Photo Set	Conditions Pre-Test	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Post-test
Expressive: **ENTRY**								
Oral identification of	1	x						
2 non-target activities;	2	x						
("What do we do here?")	3	x						
100% across students	4	x						
Expressive: **ENTRY**								
Oral identification of	1	x						
2 non-target addresses;	2	x						
("What St. is ____ on?")	3	x						
100% across students	4	x						
Expressive: **TARGET**								
Oral identification	1	x	x	x	x	x	x	x
of target photographs;	2	x	x	x	x	x	x	x
("What is this?")	3	x	x	x	x	x	x	x
0% across students	4	x	x	x	x	x	x	x
Expressive: **INCIDENTAL**								
Oral identification of	1	x	x	x				x
target photo address;	2	x		x	x			x
("What St. is ___ on?")	3	x			x	x		x
0% across students	4	x				x	x	x
Expressive: **INCIDENTAL**								
Oral identification of	1	x	x	x				x
target photo activity;	2	x		x	x			x
("What do we do here?")	3	x			x	x		x
0% across students	4	x				x	x	x
Expressive: **GENERALIZATION**								
Oral i.d. of Target	1	x						x
place by address; ("What	2	x						x
place is on _____ St.")	3	x						x
0% across students	4	x						x
Expressive: **GENERALIZATION**								
Oral i.d. of Target	1	x						x
place by activity;	2	x						x
("Where do we skate?")	3	x						x
0% across students	4	x						x

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Table 4

The Mean Percentage of Correct Responding to the Incidental Stimuli Across Students

Incidental Stimuli	Photo Set	Pre-Test	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Post-test
address	1	0%	0%	100%				100%
address	2	0%		0%	0%			0%
activity		0%		0%	100%			100%
activity	3	0%			0%	100%		100%
activity					0%	100%		100%
address	4	0%				0%	0%	0%
activity		0%				0%	100%	100%

Figure Caption

Figure 1. The mean percentages of unprompted correct responding to the target stimuli for _Jay_. The closed triangles indicate correct responses during probe conditions and in daily probes prior to constant time delay instruction. The open triangles indicate unprompted correct responses during constant time delay instructional conditions.

Figure 2. The mean percentages of unprompted correct responding to the target stimuli for _Vance_. The closed triangles indicate correct responses during probe conditions and in daily probes prior to constant time delay instruction. The open triangles indicate unprompted correct responses during constant time delay instructional conditions.

Figure 3. The mean percentages of unprompted correct responding to the target stimuli for _Chad_. The closed triangles indicate correct responses during probe conditions and in daily probes prior to constant time delay instruction. The open triangles indicate unprompted correct responses during constant time delay instructional conditions.

Figure 4. The mean percentages of unprompted correct responding to the target stimuli for _Darrel_. The closed triangles indicate correct responses during probe conditions and in daily probes prior to constant time delay instruction. The open triangles indicate unprompted correct responses during constant time delay instructional conditions.

Appendix M

Wolery, M., Ault, M. J., Doyle, P. M., Gast, D. L., & Griffen, A. K. (1990). Choral and individual responding in small groups by students with moderate mental retardation. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Comparison of Choral and Individual Responding During Small Group Instruction 1

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Running Head: Choral and Individual Responding

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Abstract

The use of choral and individual responding was evaluated in three experiments in teaching word reading to students with moderate mental retardation. A small group arrangement was used to compare a choral responding condition in which all students responded in unison, with an individual responding condition in which students responded in turn, one at a time. In Experiment I, a model-lead-test procedure was used to teach community-sign word reading and the effects of the conditions were compared when the number of exposures per stimulus was equal across conditions but the number of opportunities to respond was greater in the choral condition. In Experiment II, a model-lead-test procedure was used to teach community-sign word reading when the number of exposures per stimulus was greater in the individual condition but the number of opportunities to respond was equal across conditions. In Experiment III. a model-lead-test procedure was used to teach students to read names of local places. The most effective conditions from Experiments I and II were compared. An adapted alternating treatments design was used in all experiments. In Experiment I, the results indicated that the choral condition was the most effective condition for 3 of the 4 students, and the individual condition was the most effective for all students in Experiment II. In Experiment III, when these most effective conditions were compared, only slight differences in effectiveness and efficiency were found. Implications for classroom instruction and future research are discussed.

Comparison of Choral and Individual Responding

During Small Group Instruction

Although students with moderate mental retardation are traditionally taught in one-to-one instructional arrangements, recent research indicates they can effectively learn discrete and chained tasks in small groups (Doyle, Gast, Wolery, Ault, & Farmer, 1990; Gast, Wolery, Morris, Doyle, & Meyer, 1990; Schoen & Sivil 1989; Wolery, Ault, Gast, Doyle & Griffen, in press). In addition, several advantages exist with group instruction such as (a) allowing students access to more normalizing conditions of learning in groups (Brown, Holvoet, Guess, & Mulligan, 1980); (b) making maximum use of teacher time (Fink & Sandall, 1980); (c) developing interaction skills among group members (Alberto, Jones, Sizemore, & [illegible], [illegible]); [illegible] providing an opportunity for observational learning either in the form of learning other students' target information or learning information that is presented incidentally during a session but not specifically targeted for acquisition (Bandura, 1986; Farmer, Gast, Wolery, & Winterling, 1989; Gast, Doyle, Wolery, Ault, & Baklarz, in press; Orelove, 1982; Stevenson, 1972). A group instructional arrangement also affords the teacher some increased flexibility in structuring instructional sessions that is not possible when one-to-one instructional arrangements are used. Collins, Gast, Ault, and Wolery (in press) discuss many variables to consider that can increase flexibility of instruction when teaching students with moderate to severe handicaps in a small group. These include: (a) manipulating the size of the instructional group; (b) using homogeneous or heterogeonous student groupings in terms of age or functioning level; (c) teaching the same or different tasks to students within the same group; (d) specifically structuring peer interactions during instructional sessions (Brown et al., 1980); (e) using group-oriented contingencies (Litow & Pumroy, 1975); (f) using a predictable or unpredictable sequence of trial presentation (Ault, Wolery, Gast, Doyle, & Martin, 1990), and (g) using choral or individual responding to the attentional cue (Cybriwsky, Wolery, & Gast, in press; Wolery, Ault, Gast, Doyle, & Mills, in press) or target response (Sindelar, Bursuck, & Halle, 1986). Most of these variables have not been investigated thoroughly, thus firm recommendations can not be made as to the most effective way to conduct small group instructional sessions.

One of these variables, choral and individual responding, refers to students in the group responding in unison when the teacher gives a signal or individually when indicated by the teacher. In a review of the literature, Greenwood, Delquadri and Hall (1984) present research which indicates that increased opportunities for students to actively respond results in increased academic gains. One way for teachers to increase students' opportunities to respond is to use a choral responding format in instructional sessions. With choral responding, every student in the group responds on every trial. The DISTAR program, a widely used and effective instructional program, uses choral responding extensively (Engelmann, & Bruner, 1968). Heward, Courson, and Narayan (1989) also support the use of choral responding as a way to increase active student responding. Despite these recommendations, little empirical evidence exists to support the use of choral rather than individual responding. In a study conducted by Sindelar et al.

(1986), choral and individual student responding was compared when teaching sight word reading to students with mild handicaps. Results indicated that students learned to read the words taught in the choral responding condition at a slightly faster rate and maintained a greater percentage of these words in follow-up testing. The authors do state, however, that the results may be due to the fact that students had more opportunities to respond in the choral responding condition than in the individual responding condiiton. The purpose of this study was to evaluate the effectiveness and efficiency of a choral and individual responding condition in teaching community-sign word reading in an attempt to extend the current knowledge on effectively teaching students with moderate retardation in small group arrangements.

EXPERIMENT I

The purpose of Experiment I was to evaluate the effectiveness of choral and individual responding when the number of exposures per stimulus was equal across the two conditions but the number of opportunities to respond was greater in the choral condition.

Method

Participants and Setting

Four students, 2 males and 2 females, enrolled in a self-contained classroom for students with moderate mental handicaps participated in this investigation. The classroom was housed within a regular public school building. Prerequisite skills exhibited by all students included: (a) adequate auditory and visual abilities to see and hear stimuli presented; (b) ability to sit and attend to stimuli in a small group arrangement for a minimum of 15 minutes; (c) ability to imitate expressive verbal models; (d) ability to respond within 2 sec of a teacher signal (i.e., finger snap); and (e) ability to differentially respond in an individual condition (i.e., respond only when the teacher says the student's name), and a choral condition (i.e., respond on every trial in unison with others). Additional information on individual subjects is included in Table 1.

Insert Table 1 about here

All instructional sessions were conducted by the students' classroom teacher at a kidney-shaped table located in the back of the 6.4 x 8.9m classroom. Students sat in the same seat each session and were seated so that the stimuli, teacher directions, and the other students' responses could be easily seen and heard. During the instructional sessions, other class members not participating in the study were involved in individual activities and were supervised by the instructional assistant.

Materials

Eight community-sign words were targeted for instruction; four to be taught using choral responding conditions and four to be taught using individual responding conditions. The target words were hand printed in black ink on 10 x 15 cm index cards. Words to be taught in the choral condition were printed on white cards and words to be taught in the individual condition were printed on green cards. Plastic chips (5 x 1.5cm) were used as tokens and students selected one edible (i.e., candy, crackers, cookies) from an array following each instructional session.

Procedures

General procedures. One small group instructional session was conducted each day if all members of the group were present. A model-lead-test procedure was used to teach the community-sign words and all students in the group learned the same words. The choral responding condition (i.e., students responded in unison when the teacher signalled) was alternated daily with the individual responding condition (i.e., individual students responded in turn when signalled by the teacher). Words were assigned to the two conditions so that both sets of four words were as equal in difficulty as possible. The words were equalized by number of syllables, number of words in a community-sign, and the student's ability to receptively identify a photograph that portrayed the meaning of the sign. They were then randomly assigned to one of the two conditions. The specific words taught in the choral condition were Nurse, Post Office, Step Down, and Employees Only. Individual condition words were Doctor, No Diving, Wet Floor, and Private Property.

Probe procedures. Prior to each instructional session, daily probes were conducted with each student in an one-to-one instructional arrangement. Each probe consisted of two blocks of four trials; one block of each of the four choral words and one block of each of the four individual words. The blocks of choral and individual words were randomly alternated daily with blocks being presented in the same sequence in no more than two consecutive sessions. Within each block, the specific words were randomly alternated daily. During probe trials, the teacher presented a word card, said "Look," ensured the student looked at the card, said "What word?", waited 3 sec for a response, recorded the response during a 2-5 sec intertrial interval, and presented the next trial. Following each probe session, students were thanked and told they would participate in their group session shortly. Responses were scored as (a) correct- the student said the correct word within 3 sec of "What word?", (b) incorrect- the student said any word other than the correct one within 3 sec of "What word?", or (c) no response- the student did not say any word within 3 sec of "What word?". All responses resulted in the teacher removing the card and waiting the intertrial interval. A group criterion was used to determine when to stop training. Training was stopped when all students reached 100% correct responding on words assigned to the choral or individual condition during probe trials for one day. Individual criterion for each student was considered met when a student responded correctly on all choral or individual condition words for one probe session.

Choral and individual responding conditions. Prior to each instructional group session, the teacher told the students whether they would be responding chorally or individually. In the choral responding condition, all students in the group responded in unison when the teacher provided a signal of snapping her fingers. In the individual responding condition, individual students responded in turn from the teacher's left to right when she said their name and snapped her fingers.

Model-lead-test procedure. The community-sign words targeted for instruction were taught using a model-lead-test procedure in a small group arrangement. During instructional sessions, the four words assigned to each condition were taught at the same time and conditions were alternated daily. For 4 days prior to Christmas break, two sessions a day were conducted with the choral and individual conditions being alternated daily between morning and afternoon sessions. This was done because the teacher was told that 1 student would be leaving the classroom after Christmas although she did not. In both conditions, 16 trials were presented with each stimulus presented 4 times. In the choral condition, each student had 16 opportunities to respond (4 per stimulus) while in the individual condition each student responded only 4 times (1 per stimulus). Thus, for an individual group member, the number of exposures (i.e., the number of times a student saw a stimulus presented either to himself or to another group member) was equal across conditions, but the number of opportunities to respond (i.e., the number of times the teacher asked a student to respond per stimulus) was unequal across conditions.

The first four trials of the first instructional session of both the choral and individual conditions were model trials. All remaining trials were test trials. During model trials the teacher held up the word card, said "Everybody look," and ensured the students looked at the card. She then said "Everybody get ready" (choral condition) or "(Student's name), get ready" (individual condition), immediately modeled the correct response, and snapped her fingers as a signal for the students to respond. Correct imitations of the model were followed by the teacher saying "Good," and repeating the target word. All remaining trials were test trials in which the teacher held up the word card, said "Everybody look," ensured the students looked at the card, said "Everybody get ready" (choral condition) or "Student's name, get ready," (individual condition), waited 3 sec, and snapped her fingers as a signal for students to respond. Three kinds of individual student responses were recorded during both choral and individual instructional trials. First, a correct response was defined as the student saying the correct word within 2 sec of the signal to respond. Second, an incorrect response was defined as the student saying any word other than the correct one within 2 sec of the signal to respond. And third, a no response was defined as the student not saying any word within 2 sec of the signal to respond. During the individual condition, when correct responses occurred, the teacher said, "Good" and repeated the target word. For incorrect responses the teacher said "No, you need to say (target word)," and for no responses the teacher said, "You need to say (target word)". During the choral condition, when all students in the group made a correct response, the teacher said, "Good" and repeated the target word. When at least 1 student made an incorrect response or a no response, regardless of the responses of the other group members, the teacher said, "No, everybody needs to say (target word)". Following each instructional session, students received one token that they exchanged for back-up reinforcers at the end of the day as part of the ongoing classroom management system. They were also allowed to choose one edible from an array.

Review trials. When one group of choral or individual words met criterion in the probe sessions, students received review trials on those words during the scheduled instructional session until criterion was met on the other group of words. Review trials consisted of presenting one trial on each of the four stimuli. These trials were conducted and scored exactly like instructional test trials. The group of words that did not meet criterion continued in instruction for a maximum of 5 additional sessions. If criterion was not achieved by the fifth session, these words were taught using the other condition until criterion was met.

Experimental Design

An adapted alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985) was used to compare the effects of the choral and individual responding conditions. Two treatments were applied to different, but equally difficult behaviors, and were alternated across days. Criterion was based on probe data which was collected daily and preceded each instructional session.

Reliability

Relability assessments on student responding and procedural fidelity (Billingsley, White, & Munson, 1980) were conducted at least once a week during probe, choral, and individual conditions. Teacher behaviors that were measured during probe procedural reliability assessments included the teacher: presenting the correct stimulus, saying "Look," ensuring the student attended, saying "What word?," waiting 3 sec, providing the correct consequences, and waiting the intertrial interval. Behaviors measured during instructional procedural reliability assessments included the teacher: presenting the correct stimulus, saying "Everybody look," ensuring students looked, saying "Everybody get ready" (choral condition) or "(Student's name), get ready" (individual condition), giving the model (model trials only), waiting 3 sec (test trials only), snapping her fingers, providing the correct consequences, and waiting the intertrial interval.

Results

Reliability Estimates

Interobserver reliability on student responding and procedural fidelity was conducted during 33% of the probe sessions for Drew, Betty, and Colin, and 31% of the probe sessions for Andrea. Reliability estimates during instructional conditions were collected during 30% of the choral responding sessions for all students, 42% of the individual condition sessions for Drew, Betty, and Colin, and 45% of the individual sessions for Andrea. Student responding reliability estimates were calculated using the point-by-point method (the number of agreements divided by the number of agreements plus disagreements multiplied by 100). The mean percent of agreement on student responding during probe sessions was 94 (range 75-100), 98 (range 75-100), 93 (range 75-100), and 96 (range 88-100) for Andrea, Drew, Betty, and Colin, respectively. Student responding reliability was also collected during instructional sessions although only the probe data were used to determine criterion. The mean percent of agreement on student responding during choral condition sessions was 96 (range 94-100) for Andrea, 93 (range 75-100) for Drew, 93 (range 81-100) for Betty, 96 (range 81-100) for Colin, and was 100 for all students during individual condition sessions. Procedural reliability was calculated by dividing the number of teacher behaviors observed during a session by the number of teacher behaviors that should have occurred as written in the procedures and multiplying by 100 (Billingsley et al.. 1980). Across all students in probe sessions, mean reliability estimates were 100% for all teacher behaviors except for giving the attending cue (mean=97%, range=85-100%), giving the instructional cue (mean=97%, range=98-100%), and waiting 3 sec (mean=99.6%, range=98-100%). During group instructional sessions, reliability estimates were 100% for all teacher behaviors except for providing the correct consequences (mean=96%, range=88-100%) in the choral condition and ensuring attending (mean=99%, range=94-100%), and waiting the intertrial interval (mean=96%, range=94-100%) in the individual condition.

Effectiveness and Efficiency

The percent of correct responses across probe sessions for all students are shown in Figure 1. The closed triangles represent performance on choral condition words and the open circles represent performance on the individual condition words. The model-lead-test procedure using choral responding was effective in teaching 4 community-signs to all students without modification of the procedures. In the individual responding condition, the model-lead-test procedure was effective in teaching 4 community-signs to an individual criterion to Andrea, Betty, and Colin without modification although Andrea's responding did not maintain at criterion levels on 1 word after the [illegible]. Andrea also left the study following session 31 due to an extended illness. For Drew, an individual criterion was not met on 1 word in the individual responding condition, so during group instruction the individual words were taught using choral responding until criterion was reached. This required four sessions for Drew to meet the individual criterion and one additional session for the group to meet the group criterion.

Insert Figure 1 about here

Data from an equal number of choral and individual sessions were analyzed to determine the relative efficiency of the two conditions. Data from the first seven sessions conducted with each condition were used to compare the conditions since the eighth and all additional sessions of the choral condition were review trial sessions. These data are presented in Table 2. Following seven sessions with each condition, students had an equal number of 112 total exposures to stimuli in each condition and an unequal number opportuntities to respond with 112 in the choral condition and 28 in the individual condition. With this number of exposures and opportunities to respond, all students had responded correctly on 4 words during probes on choral words. On individual condition words during probe sessions, Andrea and Drew correctly read 3 community-sign words, Betty variably read 3-4 signs and Colin correctly identified all 4 signs. Thus, the choral condition was slightly more effective than the individual condition. The number of errors during instructional sessions ranged from 13-24 in the choral condition and 2-14 in the individual condition, however, the percent of errors in the choral condition was lower or equal to the individual condition for all students except Colin because of the greater number of opportunities to respond in the choral condition. Although choral and individual sessions had an equal number of trials, the individual sessions took 9 minutes less than the choral sessions.

Insert Table 2 about here

Discussion

In Experiment I, choral and individual responding conditions were compared. The number of exposures per stimulus was equal but the number of opportunities to respond per stimulus was unequal across conditions. The results indicated that the choral condition was slightly more efficient for 3 of 4 students when the data were compared for an equal number of sessions. The choral sessions took slightly more time than the individual sessions although the sessions had the same number of trials. This may have been because the teacher took a few more seconds each trial to score all students' responses in the choral condition as compared to 1 student's response each trial in the individual condition. Since the choral condition may have been more efficient because the number of opportunities to respond was greater than in the individual condition, Experiment II was conducted.

Experiment II

The purpose of Experiment II was to compare the effectiveness and efficiency of a choral and individual responding condition when the number of opportunities to respond per stimulus was equal and the number of exposures per stimulus was unequal across conditions.

Method

Participants and Setting

The same students, setting, and instructor that participated in Experiment I also participated in Experiment II.

Materials

Eight community-sign words were identified to be taught during Experiment II; four to be taught in the choral condition and four in the individual condition. Words were hand printed on index cards; white cards for choral words and green cards for individual words as in Experiment I. All other materials were identical to Experiment I.

Procedures

General procedures. As in Experiment I, one small group instructional session was conducted each day using a model-lead-test procedure. The choral responding condition was alternated daily with the individual responding condition. The words were randomly assigned to the two conditions once they had been equalized in terms of number of syllables, number of words, and the students' ability to receptively identify a pictorial represention of the community-sign. The words taught during the choral condition included Automotive, No Admittance, Information, and Restaurant. Words taught in the individual condition included Operator, No Trespassing, Flammable, and Prohibited.

Probe procedures. Daily probe trials were conducted prior to instructional sessions. Students received probe trials in individual sessions and the block of four choral condition words was randomly alternated with the block of four individual condition words daily. Procedures were identical to those used in Experiment I.

Choral and individual responding conditions. These conditions were the same as in Experiment I with students responding either in unison or individually. The teacher stated the condition in effect prior to beginning each session.

Model-lead-test procedure. The model-lead-test procedures were identical to those used in Experiment I except for the number of trials, exposures, and opportunities to respond presented during an instructional session. In this experiment, the number of opportunities to respond per stimulus was equal across conditions, but the number of exposures was unequal. That is, in the choral condition, a total of eight trials were presented a session with each stimulus presented twice. The individual condition sessions consisted of 32 trials with each stimulus presented 8 times. Therefore, each student in the group had 2 opportunities to respond per stimulus across conditions while they were exposed to each stimulus 2 times in the choral condition and 8 times in the individual condition.

Experimental Design

As in Experiment I, an adapted alternating treatments design was used to compare the effects of the choral and individual responding conditions. The use of each condition was alternated daily with a group of four words of equal difficulty being taught in each condition.

Reliability

Reliability assessments on procedural fidelity and student responding were conducted as in Experiment I. The same teacher behaviors as stated in Experiment I were also measured in this experiment.

Results

Reliability Estimates

Reliability estimates were calcuated as in Experiment I. Assessments on student responding and procedural fidelity were conducted during 37% of the probe sessions, 53% of the choral responding sessions, and 20% of the individual responding sessions. Mean student responding reliabilty during probe sessions was 99% (range 88-100%) for Andrea, 100% for Drew, 99% (range 88-100%) for Betty, and 100% for Colin. Mean student responding reliability estimates during choral responding sessions were 92% (range 71-100%), 97% (range 88-100%), 97% (range

88-100%), and 97% (range 83-100%) for Andrea, Drew, Betty, and Colin, respectively. During individual responding sessions, student responding reliability was 100% for all students. Procedural reliability estimates were 100% across all teacher behaviors and students in probe sessions except for teacher waits intertrial interval (mean=99.7%, range=99-100%). During choral and individual responding sessions, reliability estimates were 100% for all teacher behaviors except teacher provides correct consequences (mean=97%, range=75-100%) in the choral condition and (mean=98.9%, range=96-100%) in the individual condition, and teacher waits intertrial interval (mean=98%, range=88-100%) in the choral condition, and (mean=99%, range=97-100%) in the individual condition.

Effectiveness and Efficiency

The percent of correct responses for all students are shown in Figure 2. The closed triangles represent performance on choral condition words and the open circles represent performance on the individual condition words. The model-lead-test procedure using choral responding was effective in teaching 4 community-sign words to Colin, and variable correct responding on 2-3 words to Andrea, Drew, and Betty. The individual responding condition was effective in teaching 4 words to all students. Some modifications of the procedures as written occurred to increase correct responding. On session 24, an error correction procedure was implemented in which the teacher, following an incorrect or no response, said "No, you need to say (correct response)" (individual condition) or "No, everybody needs to say (correct response)", (choral condition) and then required students to repeat the correct response either individually or chorally depending upon the conditon in effect. In addition, following 15 sessions conducted with individual and choral responding conditions, instruction was stopped even though the group criterion had not been met in the choral condition. This was done because an equal number of sessions hrd been conducted with both conditions and the individual condition had been shown to be the most effective condition.

Insert Figure 2 about here

The number of sessions to an individual criterion in the individual condition was 7, 7, 14, and 2 for Andrea, Drew, Betty, and Colin, respectively. Colin, the only student to meet criterion in the choral condition, required 6 sessions to criterion and Andrea, Drew, and Betty still had not met criterion after 15 sessions of instruction in the individual condition. Data were analyzed from the 15 choral and 15 individual sessions in terms of number of exposures and opportunities to respond, number and percent of errors, and minutes of direct instruction time. These data are presented in Table 2. An equal number of opportunities to respond (120) in each condition was presented with an unequal number of exposures in the choral condition (120) and individual condition (474). With 120 exposures and opportunities to respond in the choral condition, during probe sessions, Andrea responded correctly on 1 sign, Drew had variable correct responses on 1-2 signs, Betty had read 2 signs, and Colin had learned all 4 signs. With 474 exposures and 120 opportunities to respond in the individual condition, Andrea, Betty, and Colin had learned 4 signs and Drew had learned 3-4. It should be noted that Betty had 456 exposures and 114 opportunities to respond because she was required to leave the group early during one individual session because of misbehavior. Across students, the number of errors during choral condition instructional sessions ranged from 26-58 and from 11-62 in the individual conditions. Since the opportunities to respond were equal across conditions, the percent of error can be compared. Percentages of error were 10-20% lower in the individual condition for all students except Betty who had a percent of error that was 4% lower in the choral condition. In terms of use of instructional time, the indiviudal sessions took approximately 2.5 times longer to conduct than the choral sessions, but the individual sessions had 32 trials compared to choral sessions which had only 8 trials per session.

Discussion

In Experiment II, choral and individual responding conditions were compared when the number of opportunities to respond per stimulus was equal across conditions (i.e., two per stimulus), but the number of exposures per stimulus was unequal with two per stimulus in the choral condition and eight per stimulus in the individual condition. The results indicated that the individual condition was more effective than the choral condition with only 1 of the 4 students meeting criterion in the choral condition after 15 sessions of instruction. Since the individual condition may have been more effective and efficient due to the greater number of opportunities to respond, Experiment III was conducted.

EXPERIMENT III

The purpose of Experiment III was to compare the most effective and efficient conditions from Experiments I and II. The choral condition, in which students had four exposures and four opportunities to respond per stimulus each session, was compared to the individual condition, in which students were exposed to each stimulus eight times and had two opportunities to respond per stimulus each session.

Method

Participants and Setting

Three subjects from Experiments I and II, Andrea, Drew, and Colin participated in Experiment III. A fourth subject, Jarrod, replaced Betty since she was leaving the classroom. Jarrod was 7 yr 2 mo old. He obtained an IQ score of 51 as measured by the Stanford-Binet. Jarrod was diagnosed as moderately mentally handicapped and was nonambulatory as a result of spina bifida. He was able to read a few safety symbols and perform simple workshop tasks. He communicated by speaking in complete sentences.

Materials

In this experiment, eight phrases which contained the names of places in the students' local community were identified to be taught; four with choral responding procedures and four with individual responding procedures. The phrases were written in black ink on white cards for those taught in the choral condition and green cards for those taught in the individual condition. All other materials used were identical to Experiment I.

Procedures

General procedures. As in Experiment I, one small group instructional session was conducted each day if all students were present. A model-lead-test procedure was used to teach students to expressively read phrases which were the names of local places. The two instructional conditions, choral and individual responding, were alternated across days. Once the phrases were equalized as to difficulty in terms of the number of words in a response and the student's ability to receptively identify a photograph of the place, they were randomly assigned to a condition. The four phrases taught in the choral condition included Children's Palace (toy store), Rupp Arena (basketball arena), Health Department, and Triangle Park (city park). The phrases taught during the individual condition included Turfland Mall (shopping mall), Festival Market (dining and shopping facility), Commonwealth Stadium (football arena), and Humane Society (animal shelter).

Probe procedures. Individual daily probe trials were conducted each day prior to instructional sessions. The eight phrases were presented in blocks of four trials of choral and individual stimuli and the blocks were randomly alternated daily. All other procedures were identical to Experiment I.

Choral and individual responding conditions. The choral and individual responding conditions consisted of students responding in unison (choral condition) or individually as called on by the teacher (individual condition) as in Experiment I.

Model-lead-test procedure. The model-lead-test procedures were identical to those used in Experiment I except for the number of trials, exposures, and opportunities to respond presented during an instructional session. In this experiment, the most efficient conditions from Experiments I and II were compared. The choral condition was implemented exactly as in Experiment I. That is, 16 trials were presented each session, in which each student had 4 opportunities to respond per stimulus and 4 exposures per stimulus. The individual condition was implemented exactly as in Experiment II, in which 32 trials were presented each session. Each student had 2 opportunities to respond and 8 exposures per stimulus.

Experimental Design

An adapted alternating treatments design was used to compare the effects of the choral and individual responding conditions.

Reliability

Reliability assessments on student responding and procedural fidelity were collected at least once per week and were conducted as in Experiment I.

Results

Reliability Estimates

Reliability assessments on student responding and procedural fidelity were calculated as in Experiment I and were collected during 29% of the probe sessions, 43% of the choral responding sessions, and 29% of the individual responding sessions. Mean student responding reliability was 100% for all students in probe, choral responding, and individual responding sessions. Procedural reliability was also 100% for all teacher behaviors in all conditions.

Effectiveness and Efficiency

The percent of correct responses for all students are shown in Figure 3. The closed triangles represent performance on choral condition words and the open circles represent performance on individual condition words. Due to time limitations because of the end of the school year, seven sessions in each condition were conducted before the experiment ended. The total number of exposures across seven sessions was 112 in the choral condition and 224 in the individual condition; number of opportunties to respond was 112 in the choral condition and 56 in the individual condition. The comparison data are presented in Table 2. The choral condition was effective in teaching all 4 names of places to Andrea and Colin, a variable 2-3 phrases to Drew, and 1 phrase to Jarrod. The individual condition resulted in Colin correctly reading 4 phrases, Andrea and Drew reading a variable 3-4, and Jarrod reading no phrases during probe sessions. Only slight differences between the two conditions were found and no modifications of the procedures as written were made. The mean number of errors across students was 26 in the choral condition and 25.5 in the individual condition. Percent of error was lower across students in the choral condition but the choral condition also presented students with twice the number of opportunities to respond. The choral condition also took 25 less minutes of instruction time although only 16 trials per session were presented in this condition compared to 32 trials per session in the individual condition.

Insert Figure 3 about here

Discussion

The model-lead-test procedure was effective in establishing criterion level responding for 2 students in the choral condition, and 2 students in the individual condition, although 1 student's responding did not maintain at criterion levels. The two most effective and efficient conditions from Experiments I and II were compared and only slight differences were found in terms of the superiority of one condition over another. The two conditions were compared based on data from seven sessions. Because of the end of the school year, the effects of the conditions later in instruction were not able to be compared.

General Discussion

The purposes of these experiments were to compare the effects of a choral and individual responding condition when (a) the number of exposures per stimuli were equal across conditions, (b) the number of opportunities to respond were equal across conditions, and (c) the two most effective and efficient conditions from Experiments I and II were implemented. In Experiment I, when exposures were equal across conditions but opportunities to respond were greater in the choral condition, the choral condition was slightly more effective. Using traditional efficiency measures, the minutes of instructional time were less in the individual condition probably because the teacher took more time to score all group members' responses. The percent of errors were not compared because the number of opportunities to respond was much greater in the choral condition. In Experiment II, when opportunities to respond were equal, but exposures were greater in the individual condition, the individual condition was more effective and the percent of error was substantially lower for 3 of the 4 students. The individual sessions took longer to conduct due to the larger number of trials. In Experiment III, when the most effective conditions from Experiments I and II were compared (i.e., the choral condition from Experiment I and the individual condition from Experiment II), only slight differences in effectiveness were found. Based on these results, a specific recommendation for teachers to use choral or individual responding cannot be made. It appears, however, that the number of exposures and opportunities to respond did play an important role in student responding. When either of these variables were increased, students responded more effectively. Even when students were exposed to stimuli but were not asked to respond, the increased number of exposures seemed to increase correct responding. In Experiment I when the ratio of opportunities to respond in the choral condition to opportuntities to respond in the individual condition was 4:1, the choral condition was more effective. Additionally, In Experiment II, when the ratio of exposures in the choral condition to exposures in the individual condition was 1:4, the individual condition was more effective. However, in Experiment III, when the ratio across conditions of exposures and opportunities to respond was reduced to 1:2, slight differences were found. Therefore, it appears that when the number of exposures or opportunities to respond are much greater in one condition over another, students learn more effectively when they have more exposures or responses, regardless if choral or individual responding occur.

Implications for classroom instruction are that teachers should be aware of the number of exposures and opportunities to respond that students receive in an instructional session and increase these whenever possible for maximum learning. Choral or individual responding are both effective when students have enough exposures or opportunities to respond, although a choral responding condition always needs some type of individual assessment component to insure each student's progress in the group. It may be easier to [illegible] and opportunities to respond by using choral responding, since the number of trials in a session does not have to be greatly increased as in the individual condition. Future research should examine variables that would lead to more efficient learning, including the optimum number of exposures and opportunities to respond, optimum number of trials in a session, the relationship of choral and individual responding to exposures and opportunities to respond, and the effects of active student responding compared to observational exposures of target stimuli.

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Table 1

Description of Students

Name Gender	C.A.	Test	Score Diagnosis	Functioning Level
Andrea Female	10yr 7mo	Wechsler Intelligence Test for Children-R	Full scale IQ 48; Down syndrome	Reads many recipe, food, and survival words; performs complex cooking chains; speaks in complete sentences.
Drew Male	12yr 11mo	Kaufman Assessment Battery for Children	Full scale IQ 48	Reads survival and food words; performs simple workshop chains; speaks in complete sentences.
Betty Female	11yr 4mo	Stanford-Binet	Full scale IQ 42; Down syndrome; Attention Deficit Disorder	Reads survival and food words; performs simple workshop chains; speaks in 2-4 word phrases.
Colin Male	13yr 4mo	Stanford-Binet	Full scale IQ 33; Down syndrome; Unilateral hearing loss	Reads many recipe, food, and survival words; performs complex cooking chains; speaks in 2-3 word phrases.

Table 2

Efficiency Data for Choral Responding and Individual Responding Conditions

EXPERIMENT I

Condition / Student	Trials per session	Exposures per session	OTR[a] per session	Exposures per stimulus per session	OTR per stimulus per session	Total # Exp	Total # OTR	# Stimuli Mastered				Number/Percent of Errors				Minutes of Instruction
								Andrea	Drew	Betty	Colin	Andrea	Drew	Betty	Colin	
Choral	16	16	16	4	4	112	112	4	4	4	4	13/12%	23/21%	24/21%	15/13%	35
Individual	16	16	4	4	1	112	28	3	3	3-4	4	7/25%	6/21%	14/50%	2/7%	26

EXPERIMENT II

Condition / Student	Trials per session	Exposures per session	OTR per session	Exposures per stimulus per session	OTR per stimulus per session	Total # Exp	Total # OTR	# Stimuli Mastered				Number/Percent of Errors				Minutes of Instruction
								Andrea	Drew	Betty	Colin	Andrea	Drew	Betty	Colin	
Choral	8	8	8	2	2	120	120	1	1-2	2	4	33/28%	46/38%	58/48%	26/[illegible]%	44
ndividual	32	32	8	8	2	474[b]	120[c]	4	3-4	[illegible]	4	21/18%	21/18%	62/52%	11/9%	112[d]

XPERIMENT III

ondition / Student	Trials per session	Exposures per session	OTR per session	Exposures per stimulus per session	OTR per stimulus per session	Total # Exp	Total # OTR	# Stimuli Mastered				Number/Percent of Errors				Minutes of Instruction
								Andrea	Drew	Jarod	Colin	Andrea	Drew	Jarod	Colin	
horal	16	16	16	4	4	112	112	4	1-3	1	4	14/13%	20/18%	53/49%	15/13%	44
ndividual	32	32	8	8	2	224	56	3	2-4	0	4	25/45%	18/32%	47/84%	12/21%	69

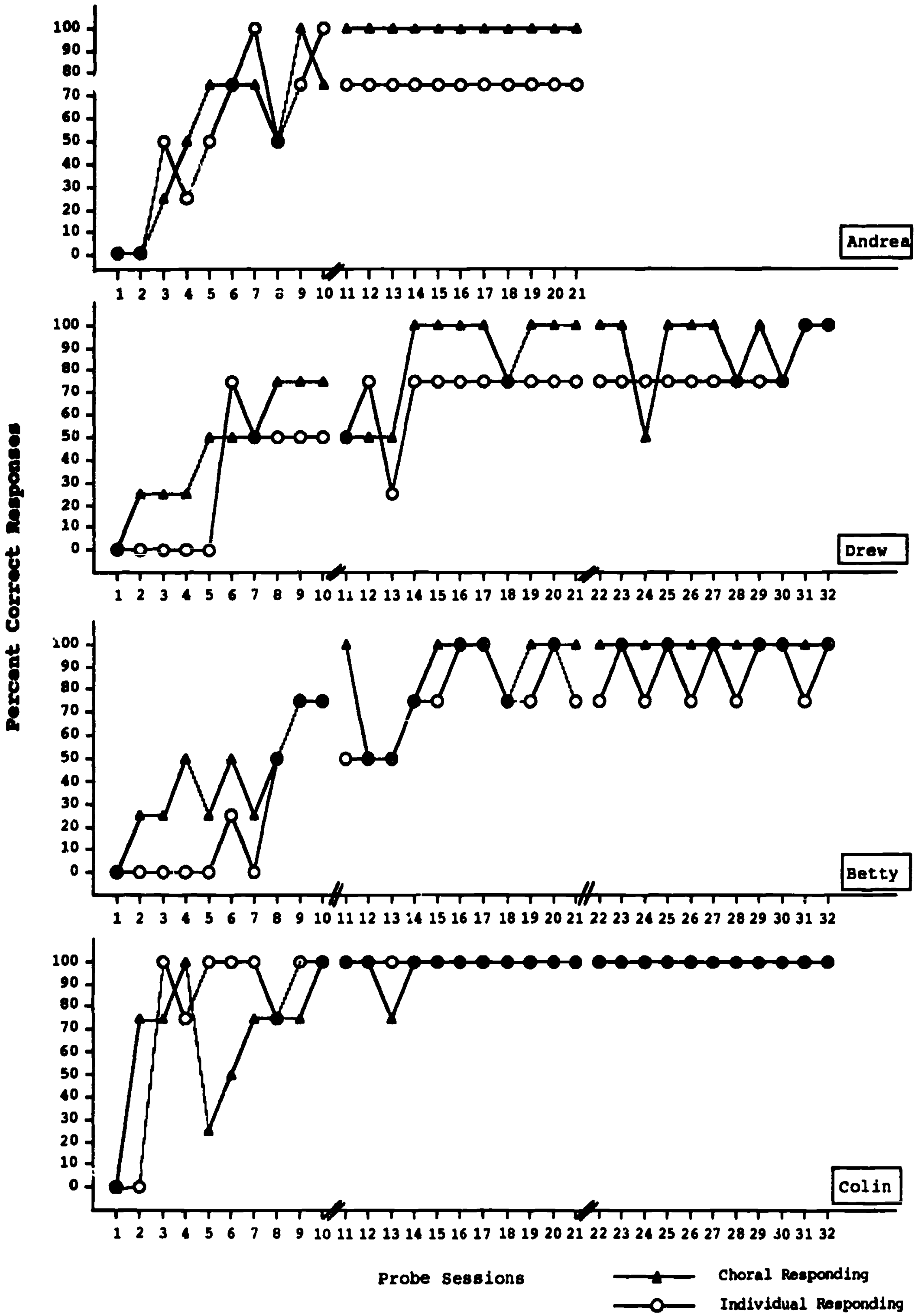
Opportunities to Respond
Betty had 456 exposures because she was required to leave one session early due to misbehavior
Betty had 114 opportunities to respond because she was required to leave one session early due to misbehavior
Betty had 114 minutes of instruction because she was required to leave one session early due to misbehavior

Figure Captions

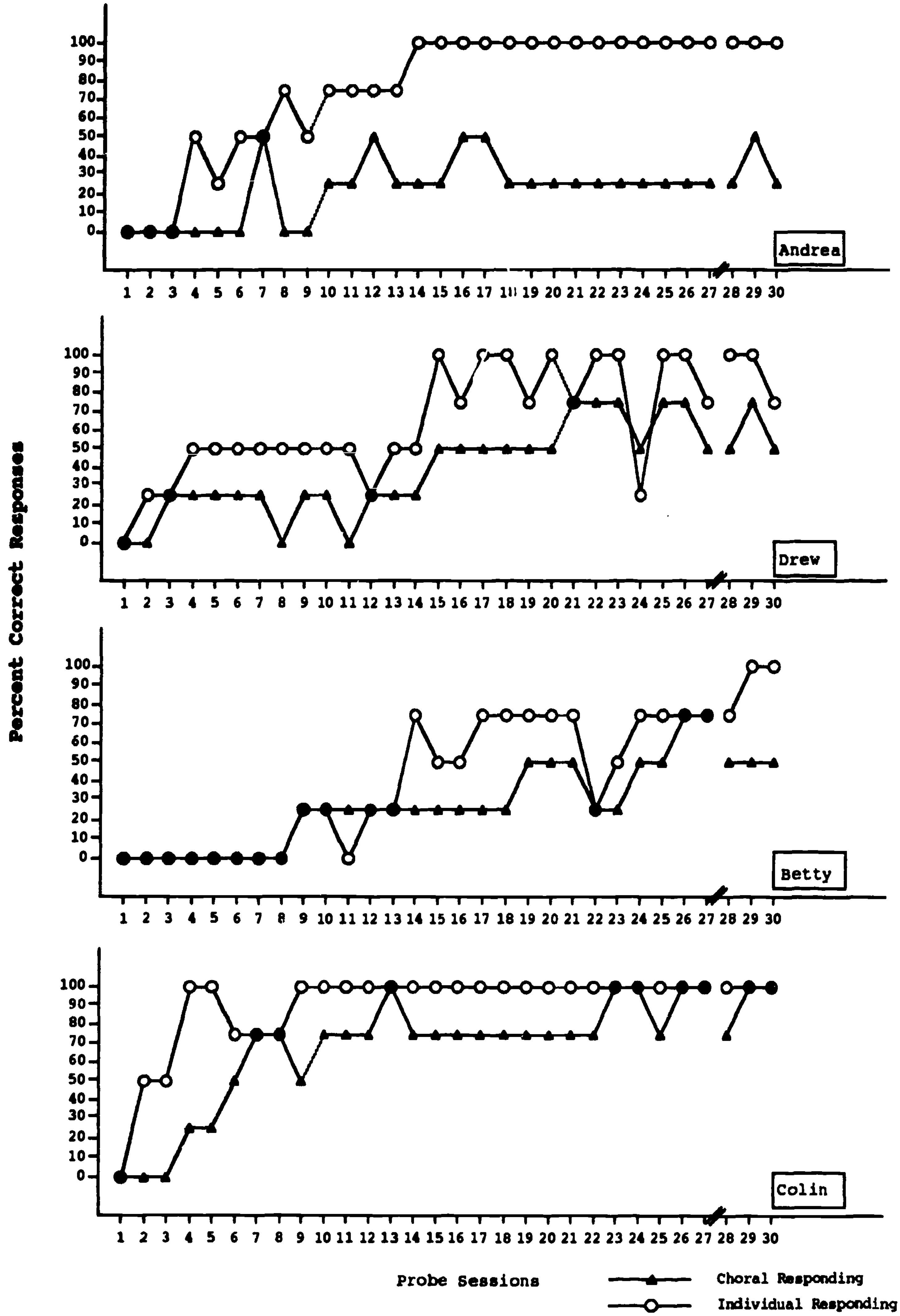
Figure 1. The percent of correct responses for each student on community-sign words taught with choral and individual responding conditions. Probe sessions are labeled along the abscissa. Dashed lines indicate a 1-4 weekday break between sessions. Break lines represent an interruption in instruction of at least 1 school week.

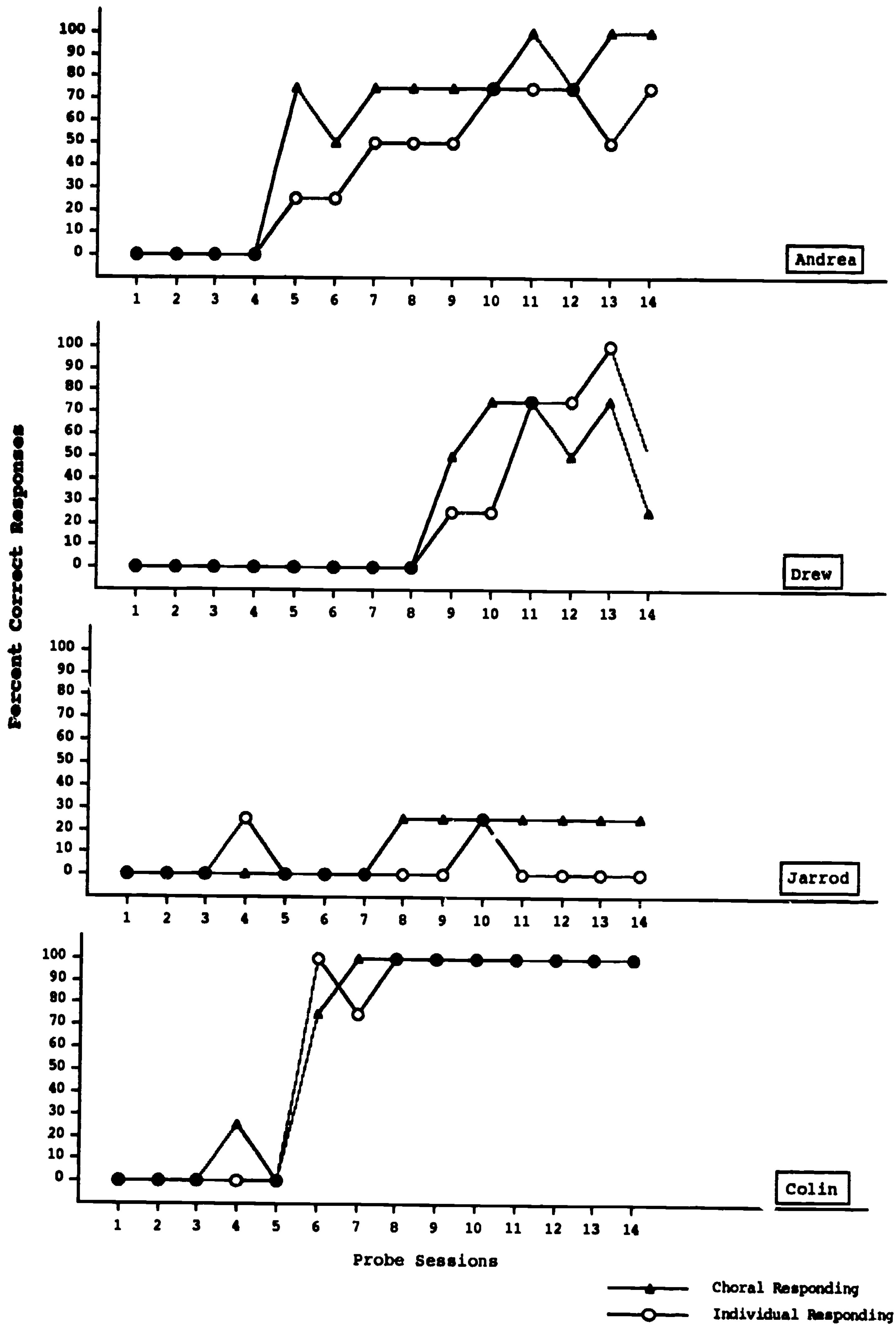
Figure 2. The percent of correct responses for each student on community-sign words taught with choral and individual responding conditions. Probe sessions are labeled along the abscissa. Dashed lines indicate a 1-4 weekday break between sessions. Break lines represent an interruption in instruction of at least 1 school week.

Figure 3. The percent of correct responses for each student on names of local places taught with choral and individual responding conditions. Probe sessions are labeled along the abscissa. Dashed lines indicate a 1-4 weekday break between sessions. Break lines represent an interruption in instruction of at least 1 school week.



Percent Correct Responses
Andrea
Drew
Betty
Colin
Probe Sessions
Choral Responding
Individual Responding


Percent Correct Responses
100
90
80
70
60
50
40
30
20
10
0
Andrea
Drew
Betty
Colin
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Probe Sessions
Choral Responding
Individual Responding



Percent Correct Responses
100
90
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30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Andrea
Drew
Jarrod
Colin
Probe Sessions
Choral Responding
Individual Responding

Appendix N

Ault, M. J., Wolery, M., Gast, D. L., Doyle, P. M., & Meyer, S. (1990). Comparison of specific and general attentional responses during small group instruction. Unpublished manuscript, Lexington, KY: Department of Special Education, University of Kentucky.

Comparison of General and Specific Attentional Responding During Small Group Instruction 1

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Running Head: Attentional Responding

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Abstract

The use of a general and specific attentional response was evaluated in teaching discrete tasks (i.e., safety symbol identification, numeral identification, and photograph identification) to 4 students with moderate mental retardation. A constant time delay procedure was used in a small group instructional format. A general attentional response in which students were required to simply look at the stimulus before responding, was compared with a specific attentional response condition in which students were required to match the target stimulus before responding. An adapted alternating treatments design was used to compare the conditions. The results indicated that all students learned all responses in both conditions. Efficiency data in terms of sessions, errors, and instructional time to criterion were compared. The general condition was more efficient in terms of sessions to criterion for 3 of the 4 subjects with the specific condition being slightly more efficient for the fourth. The two conditions were essentially equal in terms of percent of errors to criterion for all subjects. The general condition resulted in less direct instructional time for the group because of the additional time required to perform the specific attentional response. Observational learning (i.e., students' ability to name other students' target stimuli) was also measured. Three of the 4 students learned more observational stimuli that were taught in the specific attentional response condition while 1 student learned more of the stimuli taught in the general attentional response condition.

Comparison of General and Specific Attentional Responding

During Small Group Instruction

The constant time delay procedure has been shown to be an effective and efficient instructional strategy in both one-to-one and small group instructional arrangements. In small groups, it has been used successfully in teaching both discrete and chained tasks to students with handicapping conditions ranging from severe to mild (Doyle, Gast, Wolery, Ault, & Farmer, 1990; Gast, Wolery, Morris, Doyle, & Meyer, 1990; Schoen & Sivil 1989; Wolery, Ault, Gast, Doyle & Griffen, in press; Wolery, Cybriwsky, Gast, & Boyle-Gast, in press). One way to enhance the effectiveness and efficiency of this procedure may be to increase students' attention to the stimuli prior to the delivery of the task direction. Researchers have noted the importance of attention in effective teaching practices (Becker, Engelmann, & Thomas, 1975; Wolery, Bailey, & Sugai, 1988). Use of an attentional cue and response prior to the delivery of the task direction allows the teacher to evaluate whether students are attending to the target stimuli (Collins, Gast, Ault, & Wolery, in press). Several types of attentional cues and responses can be used by the teacher. An attentional response can first be defined by the response required of the student; whether it is active or inactive. An active attentional response requires the student to actively perform a response (i.e., direct their eyes toward a stimulus card, trace their finger over a stimulus). An inactive attentional response does not require the student to perform an active response (i.e., the teacher says, "Let's begin," the teacher writes a word before the student is asked to read it). Attentional responses are also defined by being general or specific. A general attentional response refers to the student being asked to attend to the stimulus in general (i.e., teacher says "Look " "Eyes on card" before asking student to respond). A specific attentional response requires the student to attend to the relevant characteristics of the stimulus (i.e., match the stimulus, say the letter names of a stimulus, or trace the stimulus before responding). Both general and specific attentional responses can require an active or inactive response from the student. In a study conducted by Wolery et al. (in press), an active, general attentional response was compared with an active, specific attentional response in teaching four sets of information to adolescents with learning and behavior disorders. The general response required students to look at the target stimulus before responding, while the specific response required students to repeat the task direction before responding. Results indicated that acquisiton of target stimuli was not differentially affected by the general or specific attentional response, but the specific attentional response did facilitate the maintenance of observational stimuli and acquisiton of related, non-target behaviors. In another study, Alig-Cybriwsky, Wolery, and Gast (1990) compared an active, general attentional response with an active, specific attentional response with preschoolers with developmental delays in teaching sight word reading. The general response required students to look at the stimulus before being asked to read it. The specific attentional response required students to say the letter names after the teacher before being asked to read the word. The results indicated that the acquisition of target stimuli was not differentially affected by the type of attentional response used, but students were able to expressively read and receptively identify more of the other group members' words that were taught with a specific attentional response.

The purpose of this investigation was to compare the effectiveness and efficiency of a constant time delay procedure used with an active, general attentional response versus an active, specific attentional response on the acquisition of target and observational behaviors.

Method

Participants and Setting

Four students, 3 males and 1 female, enrolled in a self-contained classroom for students with moderate mental handicaps participated in this investigation. The classroom was housed within a regular public school building. Prerequisite skills exhibited by all students included: (a) adequate auditory and visual abilities to hear and see stimuli presented; (b) ability to sit and attend to stimuli in a small group arrangement for a minimum of 15 minutes; (c) ability to imitate an expressive teacher model; (d) ability to wait at least 4 sec for a prompt from the teacher; and (e) ability to match the target stimuli. Additional information on individual subjects is included in Table 1.

Insert Table 1 about here

All instructional sessions were conducted by the students' classroom teacher at a semicircular table located in the back of the 6.4m x 8.9m classroom. Students sat in the same seat each session and were seated so that the stimuli, teacher directions, and the other students' responses could be easily seen and heard. During the instructional sessions, students in the class not participating in the study were involved in individual activities and were supervised by the instructional assistant.

Materials

Six different stimuli were targeted to be taught to each student. Carrie and Chris learned safety signs and symbols, Brandon learned to name photographs of clothing, and Jarrod was taught to name numerals. For each student, three stimuli were to be taught using a general attentional response and three stimuli were to be taught using a specific attentional response. In addition, two known stimuli were identified for each student. The safety signs and symbols were professionally printed on 10 x 15 cm white cards and either contained words only, symbols only, words and symbols, were in color, or in black in white depending on the sign. The photographs were in color on 20cm x 25.5cm cards, and the numerals were hand-printed in black ink on 10 x 15 cm white index cards. The stimuli used as distractors in the matching task of the specific condition were identical to the target stimuli for Brandon and Jarrod. For Chris and Carrie, a variety of distractors were used in an attempt to emphasize the relevant characteristics of the stimuli. All distractors were in black and white regardless of the color of the target stimulus. The words and/or symbols on some distractors were also reduced in size or were in a different position on the stimulus card than on the target stimulus. The distractors to be used were chosen randomly each trial. For Carrie, Jarrod, and Chris, pennies were used as tokens and a clear, plastic cup was used as a container to hold the tokens. Brandon received a choice of a small edible instead of pennies. All students chose one back-up reinforcer at the end of each session from a box containing small pieces of candy, crackers, stickers, trinkets, etc.

Procedures

General procedures. Two small group instructional sessions were conducted each day; one session using a general attentional response and one session using a specific attentional response. Sessions were conducted if at least 3 of the 4 group members were present and were at least 4 hours apart. A constant time delay procedure was used to teach each student in the group a different set of stimuli. Stimuli were assigned to the two conditions so that both sets of three stimuli were as equal in difficulty as possible. The safety-sign symbols were equalized by number of syllables, number of words in a response, and whether the stimulus contained a symbol only, words only, or both. The photographs were equalized by the student's ability to receptively identify the stimuli. The numerals were equalized by the student's ability to receptively identify the written numerals and the number set. After the stimuli were equalized, they were randomly assigned to one of the two conditions and are listed in Table 1. Other students' target stimuli served as observational learning stimuli.

Baseline. Prior to instruction, group sessions were conducted to assess the students' performance on the identification of the target stimuli for a minimum of three sessions or until responding was stable. Baseline sessions consisted of a total of 32 trials in which students received 1 trial on each of their target and known stimuli. Trials were presented in an unpredictable sequence with no student receiving consecutive trials. During baseline sessions the teacher said "Are you ready?" to the entire group, waited for an affirmative response from all students, held up the stimulus card, said "(Student's name), look," ensured the student looked at the card, said "What's this?," waited 4 seconds (silently counted "1001, 1002," etc.), recorded the student's response, provided the appropriate consequences, and waited 2-3 sec intertrial interval before delivering the next trial. Responses were scored as (a) correct- student said the correct response within 4 sec of "What's this?", (b) incorrect- student said a word other than the correct one within 4 sec of "What's this?", and (c) no response- student did not say any word within 4 sec of "What's this?". When a correct response occurred, the teacher said, "Good," repeated the correct response and delivered one token or edible. When incorrect or no responses occurred, the teacher waited the intertrial interval and delivered the next trial.

General and specific attentional response conditions. Prior to each instructional group session, the teacher told the students whether they would be using a general or specific attentional response during the session. In the general condition, students were required to look at the stimulus before the teacher provided the task direction. In the specific condition, students were required to match the stimulus from a sample of two distractors before the teacher provided the task direction.

Constant time delay procedure. The target stimuli were taught using a constant time delay procedure in a small group arrangement. During instructional sessions, the three stimuli assigned to each condition for each student were taught concurrently. Conditions were randomly alternated across morning and afternoon sessions with a condition being presented the same time of day for no more than 2 consecutive sessions. In both conditions, a total of 36 trials were presented during a session. For each student, each target stimulus was presented 3 times and trials were presented in an unpredictable sequence. No student received consecutive trials and no one stimulus was presented consecutively. The first instructional session in both conditions was conducted using a 0-sec delay. All subsequent sessions were conducted using a 4-sec delay. The controlling prompt was the teacher providing a vocal model of the target response. During the 0-sec delay session the teacher explained the condition in effect, said "Are you ready?" to the entire group, waited for an affirmative response from all students, said "(Student's name), look" (general condition), or placed two distractors on the table held up the target stimulus, and said "(Student's name), find same" (specific condition), ensured the student looked (general condition) or matched correctly (specific condition), said "What's this?," immediately said the correct response, provided a 4-sec response interval, provided the correct consequences, recorded the response, and waited the 2-5 sec intertrial interval before presenting the next trial. During all subsequent 4-sec delay sessions the teacher explained the condition in effect, said "Are you ready?" to the entire group, waited for an affirmative response from all students, said "(Student's name), look" (general condition), or placed two distractors on the table held up the target stimulus, and said "(Student's name), find same" (specific condition), ensured the student looked (general condition) or matched correctly (specific condition), said "What's this?," waited 4 sec by counting silently ("1001, 1002," etc.) before providing the controlling prompt if needed, provided the correct consequences, recorded the response, and waited the 2-5 sec intertrial interval before providing the next trial.

Five types of student responses were scored including: (a) unprompted correct responses- the student said the correct response before the teacher prompt, (b) prompted correct responses- the student said the correct response after the teacher prompt, (c) unprompted errors- the student said a word other than the correct response before the teacher model, (d) prompted errors- the student said a word other than the correct response after the teacher model, and (e) no response errors- the student did not say any word within 4 sec after the teacher model. For both types of correct responses, the teacher said "Good," repeated the correct response, and delivered one edible or token. For unprompted errors the teacher said "Wrong, let me tell you if you don't know," and modeled the correct response. For prompted errors the teacher said, "Wrong," and modeled the correct response. For no-response errors the teacher modeled the correct response. Only unprompted correct responses counted toward criterion. A group criterion was used in both the general and specific condition. Students were required to simultaneously obtain 100% correct unprompted responses for 1 session while reinforced on a continuous reinforcement schedule (CRF) followed by 2 sessions of simultaneous 100% corrrect unprompted responses while reinforced on a variable ratio of 3 schedule (VR3).

Review trials. When criterion was met in one condition before the other, review trials were conducted during one of the scheduled [illegible] sessions while instruction continued as usual in the other [illegible] Review trials consisted of each student receiving one trial on each of their three stimuli in a small group arrangement. These trials were conducted and scored exactly like 4-sec constant time delay trials.

Measurement of observational learning. During instructional sessions, each student observed a total of nine stimuli being taught to the other members of their group. The ability of each group member to identify these observational stimuli was (a) assessed after the last baseline session but prior to any instructional session and (b) following the final instructional session. Each student received 1 trial on each of the stimuli taught to the other members of the group in individual sessions. The teacher presented the card, said "(Student's name), look," ensured the student looked, said "What's this?," waited 4 seconds, and recorded the response. When a correct, incorrect, or no response occurred, the teacher waited the intertrial interval and provided the next trial. Students were given descriptive verbal praise on a VR3 schedule for looking at the cards, sitting still, etc. to maintain attention.

Experimental Design

An adapted alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985) was used to compare the effects of the general and specific attentional response conditions. Two treatments were applied to different, but equally difficult behaviors, and were alternated across days. Following the baseline condition, each student learned two groups of stimuli; one with the specific attentional response condition and one with the general attentional response condition. The conditions were randomly assigned to morning or afternoon sessions with the same condition being used at the same time of day for no more than 2 consecutive days.

Reliability

Reliability assessments on student responding and procedural fidelity (Billingsley, White, & Munson, 1980) were conducted at least once a week during both baseline and instructional conditions. Teacher behaviors that were measured during procedural reliability assessments included the teacher: explaining the condition in effect to the group (instructional conditions only); saying "Are you ready?;" waiting for an affirmative response from all group members; presenting the correct stimulus; saying "(Student's name), look," (baseline and general condition); or placing distractors on the table, holding up the stimulus and saying "(Student's name), find same," (specific condition); ensuring the student looked or matched; providing the task direction of "What's this?;" waiting 0 sec (first instructional session) or 4 sec (baseline and all other instructional sessions) and providing the prompt if needed (instructional conditions only); providing the appropriate consequences, and waiting the intertrial interval.

Results

Reliability Estimates

Interobserver reliability on student responding and procedural fidelity was conducted during 33% of the baseline sessions, 24% of the general attentional response sessions, and 26% of the specific attentional response sessions. Student responding reliability estimates were calculated using the point-by-point method (the number of agreements divided by the number of agreements plus disagreements multiplied by 100). The mean percent of agreement on student responding during baseline sessions was 97 (range 88-100) across all students. During instructional sessions, the mean percent of agreement on student responding was 100 in the general condition and was a mean percent of 98 (range 89-100) in the specific condition. Procedural reliability was calculated by dividing the number of teacher behaviors observed during a session by the number of teacher behaviors that should have occurred as written in the procedures and multiplying by 100 (Billingsley et al., 1980). Mean reliability estimates were 100% for all teacher behaviors in the baseline condition. In the general condition, reliability estimates were 100% for all teacher behaviors except for saying "(Student's name), look" (mean=99%, range=93-100%), and waiting 4 sec (mean=[illegible]7, range=92-100%). In the specific condition, reliability estimates were 100% for all teacher behaviors except for explaining the condition in effect prior to the session (mean=88%, range=0-100%), [illegible] the correct stimulus (mean=99%, range=94-100%), providing the appropriate consequences (mean=99%, range=94-100%), and waiting the intertrial interval (mean=94, range=97-100%).

Effectiveness and Efficiency

The percent of correct responses for all students are shown in Figure 1. The open circles represent performance on general attentional response condition stimuli and the closed triangles represent performance on the specific attentional response condition stimuli. During the baseline condition, responding was 0% for all students across all stimuli. The constant time delay procedure with a general attentional response was effective in teaching 3 stimuli to criterion levels to each student without modification of the procedures. Using a specific attentional response, the constant time delay procedure was effective in teaching 3 stimuli to criterion levels to each student with 2 students requiring a modification of the procedures as written in order to raise responding to criterion levels. Beginning on session 23 for Chris and session 24 for Brandon of the specific condition, a differential reinforcement procedure was implemented. With this modification, Chris received a penny plus praise and Brandon received an edible plus praise when they emitted an unprompted correct response. Prompted correct responses resulted in the teacher delivering praise only. In addition, they were required have 8 out of 9 unprompted correct responses before they received a back-up reinforcer at the end of the session. This resulted in an increase in unprompted correct responses, but did not result in criterion level responding. Finally, on session 26 the same differential reinforcement procedure was used except the students were required to earn 100% unprompted correct responses before they received a back-up reinforcer. This resulted in 100% unprompted correct responses for both boys. An additional modification of the group procedures was made beginning with session 29 where group sessions were conducted if at least 2 of the members of the group were present due to extended absences of Carrie and Brandon.

Insert Figure 1 about here

To analyze the relative efficiency of the two conditions, data from the general and specific attentional response conditions were calculated in terms of number of sessions, percent of errors, and instructional time to criterion. To compare individual student responding to criterion, data from each condition were based on the first instructional session until each individual student received 100% unprompted correct responding while reinforced on a CRF schedule for 1 session. These efficiency data are presented in Table 2. In terms of number of sessions to criterion, the general condition was more efficient than the specific condition for Brandon, Jarrod, and Chris, with Carrie reaching criterion in the specific condition 2 sessions before reaching criterion in the general condition. In terms of percent of errors to criterion, only slight differences between conditions occurred ranging from a 0-3% difference in error percentages across students. For all students, the general condition required less instructional time to criterion as a result of the additional time required for students to complete the matching attentional response in the specific condition. The average session length was 6 min 34 sec in the general condiiton as compared to 12 min 48 sec in the specific condition.

Insert Table 2 about here

Observational Learning

The percent of other students' stimuli that each student learned through observation are presented in Table 3. Carrie, Jarrod, and Chris were able to identify some of the other students' stimuli in the pre-test because of the variety of the stimuli that were taught to the members of the group. All students learned some stimuli that they observed being taught to others but were not directly taught themselves. For 3 of the 4 students, Brandon, Carrie, and Chris, a greater percent of net gain was found on stimuli taught in the specific condition.

Jarrod appeared to learn more stimuli that was taught in the general condition.

Insert Table 3 about here

Discussion

The purpose of this study was to compare the effects of the general and specific attentional response conditions on the acquisition of target and observational behaviors. The results indicated that the constant time delay procedure using both conditions was effective in teaching all stimuli to all subjects. Efficiency data indicated that the general condition resulted in fewer sessions to criterion for 3 out of 4 students, the percent of errors across conditions were relatively equal, and the general condition required less instructional time to criterion for all students. In terms of observational learning, 3 out of 4 students had a higher percent of observational learning on stimuli that were taught in the specific attentional response condition.

In this study, the specific attentional response did not appear to enhance learning over that of the general attentional response. One potential explanation for this is that students had previously learned to attend to the relevant dimensions of the instructional stimuli. Thus, the specific attentional response did not cause them to focus more attention on those dimensions. The data in this study would suggest that teachers should use general attentional respnses rather than specific attentional responses; however, two qualifications are pertinent. Firest, in previous studies when students were displaying lack of acquisition with a general attentional response, the use of a specific attention response resulted in rapid learning (cf., Doyle, Wolery, Gast, Ault, & Wiley, 1990). Thus, specific attentional responses may be useful remediation strategies when general attentional responses do not appear sufficient. A hierarchy of attentional cues/responses may be proposed which range from little response required by the student andlittle attention being called to the relevant characteristics of the stimuli to direct action being required by the student and clear focus placed on the relevant dimensions of the stimulus. Four levels of this hierarchy include (a) general inactive cues ("It's time to learn." - no response required from student); (b) general active cues "(Student's name), look." - student required to look at stimulus before proceeding with the trial); (c) specific inactive cues (teacher matches target stimuli or names letters in word to be read - student watches), and (d) specific active attentional cues (student required to match or name letters prior to reading word). When lower more parsimonious attentional cues/responses are ineffective, the higher level cues/responses may be a useful remediation stratgey.

The second qualification about specific attentional cues relates to their apparent effect on observational learning. In this study, as in others (Alig-Cybriwsky et al., 1990; Wolery et al., in press), the specific attentional cue/response appeared to facilitate observational learning. The explanation for this may be that with the specific attentional cue, the stimulus being taught was present in the learning environment for longer periods of time. The specific attentional response condition in this study required considerably longer sessions than the general attentional response condition. This is attributable to the time required to perform the matching response. Thus, while the matching response was being performed, the stimulus for the target child was exposed for a longer duration to his/her peers than when the general attentional response was being performed. Regardless of the explanation, specific attentional responses appear to facilitate observational learning. Whether the enhanced amount of observational learning justifies the use of specific attentional responses waits further experimentation.

Implications for classroom teachers suggest that if the main objective of the instruction is for students to learn their target stimuli only, then the use of the specific attentional response may not be appropriate considering the additional instructional time required to implement the procedure. However, for students who are not progressing in an instructional program, or if the teacher is interested in students learning observationally, a specific attentional response may be beneficial. Future research should focus on establishing assessments which would identify students that would benefit from the use of a specific attentional response. The efficiency of instruction could then be increased for these students by using a specific attentional response from the beginning of instruction before a remediation procedure becomes necessary. In addition, for students who appear to learn well regardless of the use of an attentional response, many variables of attentional cues and responses should continue to be examined in terms of their effects on target and observational learning. These include (a) teacher versus peer presentation of the attentional cue, (b) a choral or individual attentional response, (c) an active versus an inactive attentional response, (d) using the same attentional response on each trial versus varying the attentional responses required, and (e) maniplating the difficulty and/or length of the attentional response. Until more research is conducted, teachers should evaluate whether their students gain benefits that outweigh the increased instruction time required to use a specific attentional response.

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Table 1

Description of Students and List of Target Stimuli

Name Gender	C.A.	Target Stimuli General attentional Response Condition	Target Stimuli Specific attentional Response Condition	Test	Score Diagnosis	Functioning Level
Brandon Male	7yr 3mo	gloves pajamas tie	boots scarf shorts	None available	No score available; Down syndrome	Recognizes first name, matches colors and pictures, toilets independently; dresses independently except fasteners; speaks in one word utterances
Carrie Female	8yr 2mo	No Trespassing Emergency Police	Restrooms Fire Department Railroad	Stanford-Binet	MA 4yr 10mo; Down syndrome	Reads survival signs and days of week; writes name; identifies upper and lower case letters, numerals 1-20, coins; speaks in 3-4 word phrases
Jarrod Male	6yr 8mo	3 5 7	4 6 9	Stanford-Binet	Full scale IQ 51; Spina Bifida	Copies name; identifies 1/2 of alphabet, coins, numerals 1-10, uses calculator (enters price, subtracts from total); speaks in complete sentences
Chris Male	9yr 7mo	School Crossing Keep Out Danger	Bike Crossing No Swimming Do Not Enter	Wechsler Intelligence Test for Chilren-R	Full scale IQ 40	Writes name; reads survival signs and days of week, identifies 1/2 of alphabet, numerals 1-20; speaks in complete sentences

Table 2

Efficiency Data for General and Specific attentional Response Conditions for each Subject

Condition	Sessions to Criterion				Percent of Errors to Criterion				Direct Instruction Time to Criterion			
Subject:	Brandon	Carrie	Jarrod	Chris	Brandon	Carrie	Jarrod	Chris	Brandon	Carrie	Jarrod	Chris
General attentional Response	10	7	19	11	6	3	2	4	1hr21m	1hr3m	2hr11m	1hr26m
Specific attentional Response	15	5	21	24	3	2	2	3	3hr35m	1hr29m	4hr39m	5hr12m

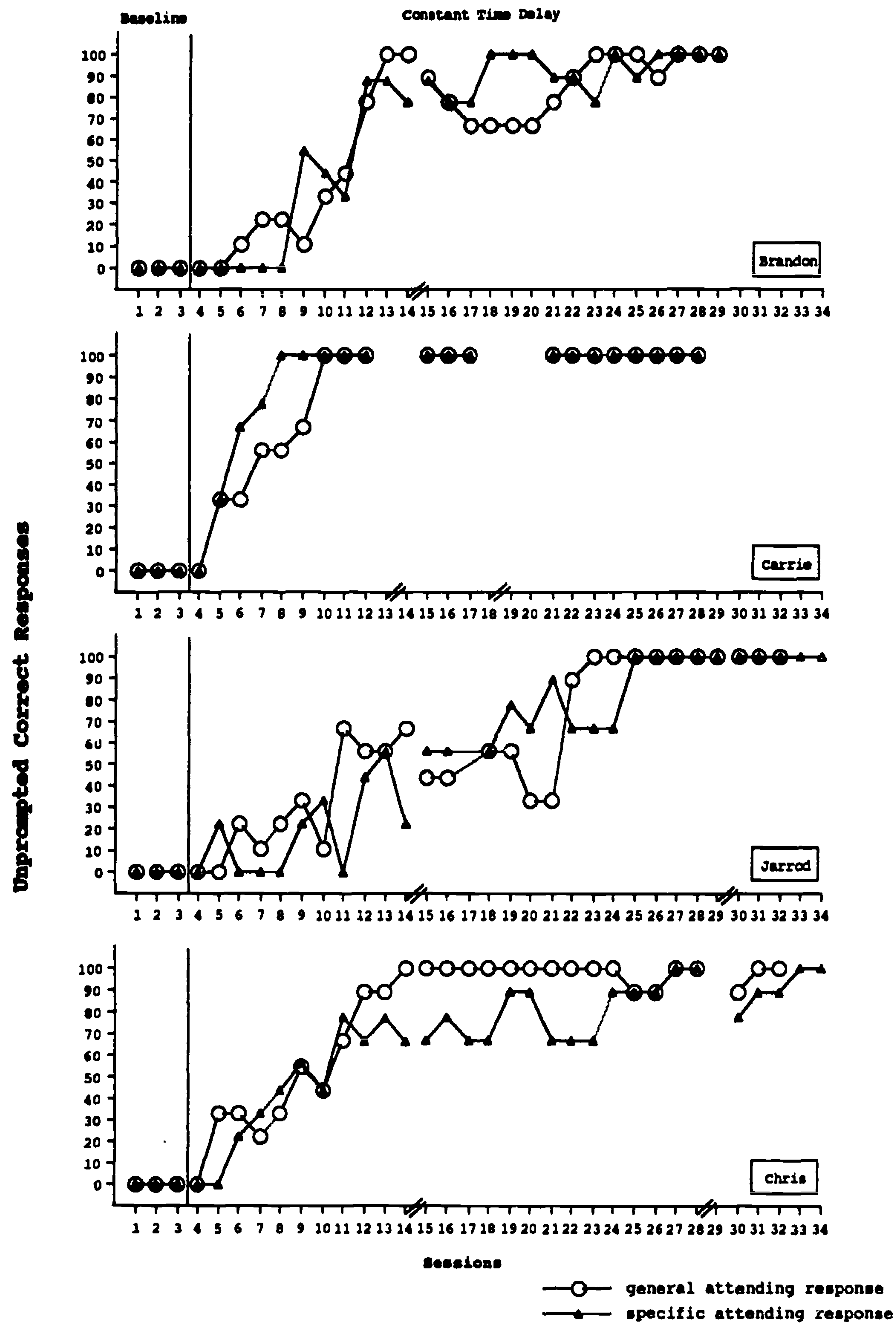
Table 3

Percent of Correct Responses and Percent of Net Gain on Observational Words

Student Condition	Pre-test	Post-test	Percent Net Gain
Brandon			
General	0	0	0
Specific	0	11	11
Carrie			
General	67	100	33
Specific	33	78	45
Jarrod			
General	22	100	78
Specific	11	78	67
Chris			
General	78	78	0
Specific	44	89	45

Figure Captions

<u>Figure 1</u>. The percent of unprompted correct responses for each student on target stimuli taught with general and specific attentional response conditions. Sessions are labeled along the abscissa. Dashed lines indicate a 1-4 day break between instructional sessions. Break lines represent an interruption in instruction of 5 days or more.


Baseline
Constant Time Delay
Unprompted Correct Responses
Brandon
Carrie
Jarrod
Chris
Sessions
general attending response
specific attending response

Appendix O

Instructional Manuals and Modules:

Doyle, P. M., Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (1990). Module: Small group instruction: Guidelines for teachers with moderate to severe disabilities. Unpublished Instructional Module, Lexington, KY: Department of Special Education, University of Kentucky.

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I N S T R U C T I O N A L   M O D U L E S:

SMALL GROUP INSTRUCTION: GUIDELINES FOR TEACHERS OF STUDENTS WITH MODERATE TO SEVERE HANDICAPS

EFFECTIVE AND EFFICIENT SMALL GROUP INSTRUCTION: THE USE OF CONSTANT TIME DELAY

Group Errorless Teaching Strategies Research Project

Department of Special Education

University of Kentucky

1990

M O D U L E:

SMALL GROUP INSTRUCTION: GUIDELINES FOR TEACHERS OF STUDENTS WITH MODERATE TO SEVERE HANDICAPS

Patricia Munson Doyle

Belva C. Collins

David L. Gast

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Module: Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps

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Department of Special Education

University of Kentucky

1990

This product is available from David L. Gast, Ph. D., Principal Investigator GETS Project, currently at 570 Aderhold Hall, University of Georgia, Athens, GA 30602. To cover printing, a $2.00 charge is requested.

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Module:

Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps

Competencies:

1. Learners will describe the findings when small group instructional arrangements are used.
2. Learners will describe the components that should be considered when using small group instructional arrangements.
3. Learners will design an effective small group instructional arrangement with a specific population.

Rationale:

A review of the literature indicated that small group instructional arrangements are a viable alternative to 1:1 instruction because (a) more than one student can receive instruction at a time, (b) small group instruction requires less personnel time, (c) small group instruction is a "less restrictive" teaching arrangement, (d) small group arrangements increase interactions between peers, and (e) students may acquire information targeted for other members of the group through observational learning. Given that small group instructional arrangements may be as effective or possibly more efficient than 1:1 teaching arrangements, teachers of students with moderate to severe handicaps should be able to first define the components that make up small group instruction and design the most effective and efficient arrangement for their population.

Objectives:

1. To describe small group instruction.
2. To describe the findings of investigations that researched the effectiveness of this instructional arrangement.
3. To describe the components that ensure the efficiency of small group instructional arrangements.
4. To design an effective and efficient small group instructional arrangement.

Prerequisites:

Learners should have knowledge and performance competencies related to systematic teaching and data collection during 1:1 instruction.

Evaluation Procedures and Criteria:

Instructors should develop their own evaluation procedures and criteria.

Learning Activities and Alternatives:

1. Read and summarize the following review documents related to small group and 1:1 instructional arrangements:

Alberto, P., Jobes, N., Sizemore, A., & Doran, D. (1980). A comparison of individual and group instruction across response tasks. Journal of the Association for Persons with Severe Handicaps, 5, 285-293.

Brown, F., Holvoet, J., Guess, D., & Mulligan, M. (1980). The individualized curriculum sequencing model (III): Small group instruction. Journal of the Association for the Severely Handicapped, 5(4), 352-367.

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Westling, D. L., Ferrell, K., & Swenson, K. (1982). Intraclassroom comparison of two arrangements for teaching profoundly mentally retarded children. American Journal of Mental Deficiency, 86, 601-608.

2. Read the following research articles that illustrate the effectiveness of small group instructional arrangements:

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Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Farmer, J. A. (1990). Use of constant time delay in small group instruction: A study of observational and incidental learning. The Journal of Special Education, 23, 369-385.

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3. Read the following research articles that investigated components of small group instructional arrangements:

Alberto, P., Jobes, N., Sizemore, A., & Doran, D. (1980). A comparison of individual and group instruction across response tasks. Journal of the Association for Persons with Severe Handicaps, 5, 285-293.

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Wolery, M., Ault, M. J., Gast, D. L., Doyle, P. M., & Mills, B. M. (in press). The use of choral and individual spelling attentional responses in teaching sight word reading during small group instruction. Remedial and Special Education.

Wolery, M., Cybriwsky, C., Gast, D. L., & Boyle-Gast, K. (in press). General and specific attentional responses: Acquisition and maintenance of target, observational, and incidental behaviors. Exceptional Children.

4. Talk with and observe teachers who are experienced in effective and efficient use of small group instructional arrangements.

5. Write a paper that describes the components (e.g., a list of, definitions of, and importance of) that make up small group instructional arrangements.

6. Write a paper that describes how to teach a specific skill to a particular population in a small group instructional arrangement.

Content Outline:

This outline relies on information presented in the manual Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps (Collins, Gast, Ault, & Wolery, 1990) and is suggested that this module be used along with the above manual and suggested readings.

1.0 Introduction to Small Group Instruction

1.1 Advantages of small group instructional arrangements - (a) more than one student can receive instruction at a time, (b) small group instruction requires less personnel time, (c) small group instruction is a "less restrictive" teaching arrangement, (d) small group arrangements increase interactions between peers, and (e) students may acquire information targeted for other members of the group through observational learning.

1.2 Definition of small group instruction - a minimum of 2 and no more than 10 students taught by an instructor at the smae time and in the same setting.

1.3 Purpose of the Module:

1.3.1. To describe small group instruction.

1.3.2. To review the findings of research using small group instructional arrangements.

1.3.3. To describe the components that make up a small group instructional arrangement.

1.3.4. To describe the rationale for selection of components that make up small group instructional arrangements.

2.0 Group Composition

2.1. Select the number of students to be taught in the group based on (a) handicaps, (b) experience, (c) attending skills, and (d) session duration.

2.2. Select the type of students, i.e., homogeneous or heterogeneous group. Include description and rationale of each type of group composition. For example, a homogeneous group might be defined as a group of students with similar diagnostic labels and/or age ranges of no more than 2 years. This type of group would enable the instructor to teach similar tasks. However, a hetergeneous group may be the only option available to the teacher and might increase the probability that students will acquire behaviors not targeted for their instruction while observing other members of the group.

2.3. Select the type of tasks. The teacher may choose to teach each member in the group the same task and the same stimuli, the same task but different stimuli, different task with the same stimuli, or different tasks along with different stimuli in the same instructional setting. The selection should be based on the type of students in the group, the task difficulty, ease in implementation, and whether the teacher would like group members to acquire other students' information through observation.

2.4. Define entry criteria for selecting students for group instruction e.g., (a) appropriate social behaviors, (b) instructional control, and (c) minimal performance on skills to be taught. Teachers should be aware that failure to consider the above criteria may result in one group member adversely effecting the performance of other members in the group.

2.5. Select the group arrangement (a) intrasequential - individual instruction for each group member with no structured interaction between members, (b) intersequential - the teacher plans for, provides opportunity, and reinforces interactions between group members, (c) tandem - the teacher begins teaching in a 1:1 arrangement and gradually increases the group size, and (d) 1:1 supplement - the teacher begins by teaching in a small group arrangement, however he or she adds 1:1 instructional sessions as students make errors in the group session. The teacher must select the type of arrangement based on ease of implementation, type of group, whether you want increased peer interactions, experience of the members in the group, and task difficulty.

2.6. Select criteria for conducting a group session, or how many students should be present? Although arbitrary, the teacher should make the decision (a) prior to beginning instruction, (b) based on absenteeism, and (c) the importance and type of skill being trained.

3.0 Procedures to be Used

3.1. Select the instructional strategy to be used in the small group arrangement based on (a) effectiveness, (b) efficiency, and (c) parsimony. Research findings indicate that the constant time delay strategy may be the procedure of choice for use in a small group instructional arrangement.

3.2. Select the type of attentional cue that will precede delivery of the task direction and ensure that students are attending within the small group arrangement. Specific attentional cue options include (a) a general cue - students are simply asked to look at or orient toward the task stimulus, or (b) a specific attending cue - students are required to attend to the relevant characteristics of the task stimulus. The type of attentional cue is dependent on student and task characteristics, and if the teacher is interested in investigating whether students can acquire information incidental to the target task.

3.3. Select the number of students who will be required to respond to the attending cue (a) individual attentional response requirement - only the student who is receiving a trial is required to attend to the task stimulus, or (b) require a choral attentional response - teacher ensures that all members of the group, regardless of who is receiving a trial, are attending to the task stimulus. The selection of the type of attentional response requirement is dependent on whether the teacher is interested in the group members acquisition of other students target tasks.

3.4. Determine presentation of the discriminative stimulus. For example, the teacher must attend to seating arrangements in order to ensure that all group members can (a) hear the task direction and/or other members, and (b) see the task stimuli and/or other members' responses. The teacher should adapt the physical environment or materials to ensure that the effectiveness of the procedure used in small group arrangements is not compromised by these variables.

3.5. Select the type of trial presentation. Some of the options include (a) predictable - during group instruction with individual trials, each group member has the opportunity to predict when his or her trial will occur because the teacher always presents instructional trials in the same student order, or (b) unpredictable - the teacher randomly selects the student order in which trials are presented. Teachers should select based on ease of implementation (predictable) versus increasing the probability that students will attend during other students trials (unpredictable). Other decisions include (c) the number of trials to be presented, (d) whether this number should be constant or vary across sessions or group members, and (e) the trial format or whether to select massed, spaced or distributed trials. These decisions are abitrary and based on student and task characteristics.

3.6. Select either choral - students respond in unison, or individual - one student responds while other group members watch, responding. Teachers should consider that during choral responding, students are continually active during the instructional session, however, you still must take the time to test individually for acquisition of the target tasks.

3.7. Define the consequences that will follow student responses in the small group instructional arrangement. The teacher can decide the type of reinforcer to follow correct responses (e.g., tangibles or social praise), and (b) the type of event to follow errors (e.g., error correction, ignore, etc.).

3.8. Select the type of criterion (a) individual - each group member moves at his or her own pace as the teacher presents new stimuli as target stimuli are acquired, independent of other member's responding, or (b) group - individual students are not presented with new behaviors until all members of the group are at criterion level performance. The teacher selects the type of criterion based on type of students in the group and the type of tasks selected for instruction.

4.0 Measuring Learning

4.1. Measure effectiveness through (a) pre- or post-tests, (b) trial-by-trial, or (c) permanent products.

4.2. Measure efficiency through data on (a) number of sessions, (b) number of trials, (c) number of errors, (d) minutes of instructional time, and (e) observational learning.

4.3. Summarize the data from the small group instructional arrangement to monitor progress of individual group members.

4.4. Measure generalization and maintenance of information learned in the small group instructional arrangement.

5.0 Management of Group Behavior

5.1. Select contingencies to follow the occurrences of inappropriate behavior in the group. The teacher may select (a) independent group contingencies - students receive consequences based on their own performance, (b) interdependent group contingencies - all students receive reinforcement based on performance of the group, or (c) dependent group contingencies - where all students in the group are reinforced dependent on one or more selected members. Selection is based on both task and student characteristics.

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MODULE:

EFFECTIVE AND EFFICIENT SMALL GROUP INSTRUCTION: THE USE OF CONSTANT TIME DELAY

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Group Errorless Teaching Strategies Project

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1990

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Module:

Effective and Efficient Small Group Instruction: The Use of Constant Time Delay

Competencies:

1. Learners will describe the findings when constant time delay is used in a small group instructional arrangement.
2. Learners will describe the steps for using constant time delay in a small group instructional arrangement.
3. Learners will design a small group instructional arrangement using the constant time delay procedure.

Rationale:

A review of the literature indicated that small group instructional arrangements are a viable alternative to 1:1 instruction (Brown & Holvoet, 1982). However, once the teacher has selected this instructional arrangement, his or her next decision is the selection of a systematic instructional strategy that will prove effective in small groups (Brown, Holvoet, Guess, & Mulligan, 1980). The constant time delay strategy has been found to be effective in small group instructional arrangements (Cybriwsky, Wolery, & Gast, in press; Doyle, Gast, Wolery, Ault, & Farmer, 1990; Winterling, 1990. Therefore, because of the effectiveness of the procedure with a variety of populations in teaching a number of different skills, teachers of students with moderate or severe handicaps should be able to implement constant time delay in a small group instructional arrangement.

Objectives:

1. To describe the constant time delay strategy.
2. To describe the findings of investigations that researched the effectiveness and efficiency of constant time delay in small group instructional arrangements.
3. To describe the steps for using constant time delay in small group instructional arrangements.
4. To design an effective and efficient small group instructional arrangement using the constant time delay strategy.

Prerequisites:

Learners should have knowledge and performance competencies related to systematic teaching and data collection during 1:1 instruction.

Evaluation Procedures and Criteria:

Instructors should develop their own evaluation procedures and criteria.

Learning Activities and Alternatives:

1. Read and summarize the following review and research documents related to small group instructional arrangements:

Brown, F., Holvoet, J., Guess, D., & Mulligan, M. (1980). The individualized curriculum sequencing model (III): Small group instruction. Journal of the Association for the Severely Handicapped, 5(4), 352-367.

Collins, B. C., Gast, D. L., Ault, M. J., & Wolery, M. (in press). Small group instruction: Guidelines for teachers of students with moderate to severe handicaps. Education and Training in Mental Retardation.

Favell, J. E., Favell, J. E., & McCimsey, J. F. (1978). Relative effectiveness and efficiency of group versus individual training of severely retarded persons. American Journal of Mental Deficiency, 83, 104-109.

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Oliver, P. R., & Scott, T. L. (1981). Group versus individual training in establishing generalization of language skills with severely handicapped individuals. Mental Retardation, 19, 285-289.

Storm, R. H., & Willis, J. H. (1978). Small-group training as an alternative to individual programs for profoundly retarded persons. American Journal of Mental Deficiency, 83, 283-288.

Westling, D. L., Ferrell, K., & Swenson, K. (1982). Intraclassroom comparison of two arrangements for teaching profoundly mentally retarded children. American Journal of Mental Deficiency, 86, 601-608.

2. Read and summarize the following documents related to constant time delay:

Ault, M. J., Gast, D. L., Wolery, M., & Doyle, P. M. (in press). A data collection and graphing method for use in teaching chained tasks with the constant time delay procedure. Teaching Exceptional Children.

Ault, M. J., Wolery, M., Doyle, P. M., & Gast, D. L. (1989). Comparative investigations of instructional strategies for students with moderate and severe handicaps: A literature review. Exceptional Children, 55, 346-356.

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Wolery, M., & Gast, D. L. (1984). Effective and efficient procedures for the transfer of stimulus control. Topics in Early Childhood Special Education, 4(3), 52-77.

3. Read the following research articles that illustrate the effectiveness and efficiency of constant time delay in small group instructional arrangements:

Cybriwsky, C., Wolery, M., & Gast, D. L. (in press). Use of a constant time delay procedure in teaching preschoolers in a group format. Journal of Early Intervention.

Doyle, P. M., Gast, D. L., Wolery, M., Ault, M. J., & Farmer, J. A. (1990). Use of constant time delay in small group instruction: A study of observational and incidental learning. The Journal of Special Education, 23, 369-385.

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Wolery, M., Cybriwsky, C., Gast, D. L., & Boyle-Gast, K. (in press). General and specific attentional responses: Acquisition and maintenance of target , observational, and incidental behaviors. Exceptional Children.

4. Talk with and observe teachers who are experienced in the use of constant time delay.

5. Talk with and observe teachers who are experienced in effective and efficient use of small group instructional arrangements.

6. Write a paper that describes the steps that comprise the constant time delay procedure.

7. Write a paper that describes how to teach a specific skill to a particular population in a small group instructional arrangement using the constant time delay procedure.

Content Outline:

This outline relies on information presented in the manual Effective and Efficient Small Group Instruction: The Use of Constant Time Delay (Winterling, Gast, Doyle, & Wolery, 1990) and it is suggested that this module be used along with the above manual and suggested readings.

1.0 Introduction to Use of Constant Time Delay in Small Group Instructional Arrangements:

1.1. Decision-making by teachers includes (a) preparations for instruction (e.g, behaviors to be taught, number of students), and (b) how to teach the behaviors to the students.

1.2. Decision-making based on (a) effectiveness and (b) efficiency.

1.3. Purpose of the Module

1.3.1. To review the findings of research using small group instructional arrangements.

1.3.2. To describe the constant time delay procedure.

1.3.3. To describe the use of constant time delay in small group instructional arrangements.

2.0 Rationale and Supporting Research:

2.1. Small group instructional arrangements are effective alternatives to 1:1 instruction. When compared to 1:1

instruction, small group instructional arrangements are equally effective in establishing a variety of new skills to varying populations.

2.2. Small group arrangements can increase the efficiency of classroom instruction in terms of efficient use of (a) teacher and staff instructional time, (b) increased opportunities for less restrictive teaching environments and peer social interactions, and (c) greater probability that students may learn other students target information.

2.3. Constant time delay has been an effective and efficient strategy when used in a small group instructional arrangement for students ranging in age from preschool to adult, with handicaps ranging from developmental delays to severe mental retardation, and in teaching both chained and discrete skills.

3.0 Description of Constant Time Delay:

3.1. Definition of time delay - a response prompting strategy involving the simultaneous delivery of a target stimulus and a controlling prompt for a limited number of trials, followed by trials where the target stimulus is presented but the controlling prompt is delayed for a "constant" period of time.

3.2. Examples illustrating the implementation of the procedure and terminology.

3.3. Definitions of the five types of student responses that can occur within a small group instructional arrangement when using the constant time delay procedure.

3.3.1. Unprompted correct responses - correct responses that occur before delivery of the controlling prompt; these count toward criterion.

3.3.2 Prompted correct responses - correct responses that occur after delivery of the controlling prompt.

3.3.3. Unprompted incorrect responses - errors that occur before delivery of the controlling prompt.

3.3.4 Prompted incorrect responses - errors that occur after delivery of the controlling prompt.

3.3.5. No responses - occur when the student does not respond after delivery of the prompt.

4.0 Teaching a New Skill to a Group of Students Using Constant Time Delay:

4.1. Select the students, and identify the target skill. These selection procedures are dependent on student handicapping conditions and task characteristics such as: same-task, same-stimuli; same-task, different-stimuli; different-task, same-stimuli; or different-task, different-stimuli.

4.2. Plan the instructional program. These decisions include:

4.2.1. Select the number of trials per student and session. Options include (a) the number of trials to be presented, (b) whether this number should be constant or vary across sessions or group members, and (c) the trial format or whether to select massed, spaced or distributed trials. Again, this decision is dependent on both the population and the skill to be trained. If the skill is difficult or each student is learning a different skill and/or different stimuli, the teacher may find it necessary to conduct a greater number of trials per student than if all students in the group are learning the same task and/or the same stimuli.

4.2.2. Select the type of trial presentation (a) predictable - during group instruction with individual trials, each group member has the opportunity to predict when his or her trial will occur because the teacher always presents instructional trials in the same student order, or (b) unpredictable - the teacher randomly selects the student order in which trials are presented. Teachers should select based on ease of implementation (predictable) versus increasing the probability that students will attend during other students trials (unpredictable).

4.2.3. **Select the type of target response requirement; either choral - students respond in unison, or individual - one student responds while other group members watch, responding. Teachers should consider that during choral responding, students are continually active during the instructional session, however, you still must take the time to test individually for acquisition of the target tasks.**

4.2.4. Select contingencies to follow occurrences of student responses in the group. The teacher may select (a) independent group contingencies - students receive consequences based on their own performance, (b) interdependent group contingencies - all students receive reinforcement based on performance of the group, or (c) dependent group contingencies - where all students in the group are reinforced dependent on one or more selected members. Selection is based on both task and student characteristics.

4.2.5. Ensure attending. This can be accomplished through a number of methods including (a) simply presenting an attending cue to each student prior to his or her trial and waiting until that student orients toward the target stimulus, or (b) presenting an attending cue and waiting for each student in the group to orient toward or look at the target stimulus. The teacher also might add specific consequences for correct attending responses to the target stimulus, such as (a) reinforcing individual students for attending to their stimuli, (b) reinforcing a specific student for attending to other students target stimuli, or (c) reinforcing only if all students are attending to target stimuli.

4.2.6. Select the task direction - a stimulus, usually verbal, that tells the students to perform the target behavior, and determine presentation of this discriminative stimulus. For example, the teacher must attend to seating arrangements in order to ensure that all group members can (a) hear the task direction and/or other members, and (b) see the task stimuli and/or other members' responses. The teacher should adapt the physical environment or materials to ensure that the effectiveness of the procedure used in small group arrangements is not compromised by these variables.

4.2.7. Identify the controlling prompt; a prompt that will ensure that students perform the target response correctly. In a small group instructional setting, the controlling prompt may vary across students dependent on type of skills being trained (e.g., if each member of the group is learning a different task, than the controlling prompts might include a model, a gesture and a physical prompt), and the characteristics of the students (e.g., if three group members are imitative and one member is not, than the controlling prompt might be a physical prompt guiding a correct response for the non-imitative student which serves as a model for the remaining three group members).

4.2.8. Identify the number of simultaneous trials at the 0-sec delay interval. This is determined by (a) the number of behaviors being trained, (b) the task difficulty, (c) the experience of the students in the group, and (d) the handicapping conditions of the members in the group.

4.2.9. Determine the length of the prompt delay interval. Although 4 and 5 seconds are common delay intervals, they should be adjusted to the learning characteristics of the students in the group; students with short latencies should receive short prompt intervals and students with long latencies might be allowed more time to respond. It should be noted that although a teacher can vary the length of the delay interval across group members, the procedure is much easier to implement if all students in the group can wait the same amount of time for delivery of the controlling prompt.

4.2.10. Select the consequences which will follow each type of student response. Both unprompted and prompted correct responses should be reinforced on a continuous schedule of reinforcement. This schedule of reinforcement should be thinned as learning is established. Errors and no responses can be followed wit a variety of consequent events including (a) ignoring, (b) mild verbal reprimands, (c) error correction, or (d) a short in-seat time out.

4.2.11. Establish a reasonable criterion: (a) individual criterion - each group member moves at his or her own pace as the teacher presents new stimuli as target stimuli are acquired, independent of other member's responding, or (b) group criterion - individual students are not presented with new behaviors until all members of the group are at criterion level performance. The teacher selects the type of criterion based on type of students in the group and the type of tasks selected for instruction.

5.0 Measuring Performance: Monitor individual performances in the group and make adjustments as needed (Gast, Wolery, Ault, Doyle, & Alig, 1988, pages 31-33; Winterling, et al., 1990, pages 23-24).

5.1. Measure effectiveness: daily data should be collected on the five possible types of student responses when using constant time delay.

5.2. Types of data collection sheets can be found in two manuals (Collins, Gast, Ault, & Wolery, 1990, pages 35-37; and Winterling et al., 1990, pages 30-32).

5.3. Measure efficiency through data on (a) number of sessions, (b) number of trials, (c) number of errors, (d) minutes of instructional time, and (e) observational learning.

5.4. Summarize the data from the small group instructional arrangement to monitor progress of individual group members. Visual representations of group time delay data sheets can be found in Collins, et al., 1990, pages 39-40; Winterling, et al., 1990, pages 34-36.

5.5 Design a systematic group instructional arrangement using the constant time delay strategy for either a discrete or chained task. Refer to Winterling et al., 1990, pages 8-23.

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SMALL GROUP INSTRUCTION: GUIDELINES FOR TEACHERS OF STUDENTS WITH MODERATE TO SEVERE HANDICAPS

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Small Group Instruction: Guidelines for Teachers of Students with Moderate to Severe Handicaps

Introduction

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Traditionally, students with moderate to severe handicaps have been taught in 1:1 instructional arrangements. Whether this is the most effective and efficient way to teach these students has not been validated. A viable alternative to 1:1 instruction is teaching in small groups. Group instruction may actually be more advantageous than 1:1 instruction because (a) teachers can instruct more than one student at a time, (b) less classroom personnel and instructional time is required, (c) students may be prepared to function in less restrictive environments which frequently use group arrangements (Fink & Sandall, 1978), (d) students may learn to interact appropriately with peers (Alberto, Jobes, Sizemore, & Doran, 1980), and (e) students may learn additional information from observing other members of the group (Westling, Ferrell, & Swenson, 1982). For our purposes, small group instruction is defined as at least 2 and no more than 10 students being taught by 1 instructor.

To make recommendations on how small groups should be designed, the current literature was reviewed and studies conducted at the University of Kentucky were examined. The literature reviewed focused on acquisition studies which involved students with moderate to severe handicaps. From this literature, a number of components were identified that should be considered when designing small group instructional programs (Collins & Gast, 1988). The body of research has not examined all of these components satisfactorily and sufficient investigations have not been conducted to determine the best way to facilitate acquisition in small groups. Therefore, the purpose of this manuscript is to inform teachers of students with moderate to severe handicaps about decisions that need to be made when developing small group instructional programs. A secondary purpose is to provide recommendations pertaining to each of these decisions. The following questions address the components of small group instruction that should be considered by teachers.

How Will Groups Be Composed?

Some of the first decisions teachers must make when designing small group instruction relate to the composition of the group. The teacher must consider what students will be in the group, how many students will be taught, what tasks will be taught, and how group members will interact.

Group size. The size of the group is one of the first decisions that teachers need to make. Of the studies reviewed, the maximum number of students taught in a small group was 7 (Winkler, Arnold, & Russell, 1987). However, most investigations included 2-4 students (Alberto et al., 1980; Brown & Holvoet, 1982; Favell, Favell, & McCimsey, 1978; Faw, Reid, Schepis, Fitzgerald, & Welty, 1981; Frankosky & Sulzer-Azaroff, 1978). The teacher, when making a decision on the number of students to include in a group, should consider the following variables: (a) the handicapping conditions of the students; (b) the students' experience in group settings; (c) the students' command of appropriate group skills, (i.e., ability to sit and attend, appropriate social skills); (d) the type of task to be taught; and (e) session length. For example, students with more severe handicaps, may have limited experience in groups, may not be able to sit for long periods of time, may not possess the necessary social skills (e.g., standing or sitting in close proximity to others, turn-taking, compliance) and may have longer responding times. In such cases, the teacher may want to involve a smaller number of students in the group to shorten session length and to instruct all members of the group adequately. On the other hand, students who have some group experience and possess the necessary prerequisite skills may be able to function as a member of a larger group.

Homogeneous/heterogeneous groupings. Based on the student population of the classroom and the tasks identified to be taught, the teacher must decide if homogeneous or heterogeneous groupings will be used. For the purpose of this manuscript, homogeneous groupings were defined as groups containing students with the same diagnostic label and/or with an age span of no more than 2 chronological years; heterogeneous groupings were defined as groups containing students who function at different levels and/or have age spans of greater than 2 chronological years. For example, Alberto et al. (1980) taught self-help and language skills to students who all had severe handicaps and who ranged in age from 6-8 years, while Favell et al. (1978) taught word recognition to students whose ages ranged from 9-25 years and whose disabilities ranged from moderate to profound levels. An advantage of homogeneous groupings for the teacher may be the ease with which the group is conducted since it is more likely that all students in the group will learn the same type of task and will have the same skill level. However, identifying a group of students that are similar in age and handicapping conditions may be difficult and unrealistic, especially if students participate in groups in least restrictive or community settings. Conducting a group with a heterogeneous population may be more difficult since students will probably be learning a variety of skills, but students may have a greater opportunity to learn additional information by observing the other group members.

Task selection. Students in the group may all be working on the same type of task using either the same stimuli or different stimuli. Alternatively, each student in the group may be learning a different type of task, again with either the same stimuli or different stimuli. An example of "same task, same stimuli" was used by Doyle, Gast, Wolery, Ault, and Meyer (1989) when they taught all students in the group to read the same words off a menu from the community. Kohl (1981) used a "same task, different stimuli" format when each student in a group was taught to manually sign different stimuli. "Different task, same stimuli" was used by Horst, Wehman, Hill, and Bailey (1981) in teaching leisure skills to adolescents with severe handicaps; each student in the group learned to perform a different leisure skill with the same stimuli, a frisbee. Finally, Brown and Holvoet (1982) used a "different task, different stimuli" format in teaching clerical skills to students with profound mental retardation; each student learned a different clerical skill using different materials. Obviously, the needs of the group should be assessed to determine what tasks will be taught. When different tasks or stimuli are used, students have the potential to learn what is being taught to other members of the group (Wolery, Ault, Gast, Doyle, & Mills, 1989). This is not possible when all members of the group are using the same stimuli. The teacher should realize that teaching the same task or same stimuli to group members increases the ease with which the group is conducted and may affect how quickly students learn.

Entry criteria. When choosing students to be members of the group the teacher should ensure that each member has the skills necessary for successful participation. These might include appropriate social behaviors (Marchetti, Cecil, Graves, & Marchetti, 1984), eye contact with the teacher and stimuli (Alberto et al., 1980), compliance to task requests (Faw et al., 1981), and minimal performance on skills to be taught (MacDonald, Dixon, & LeBlanc, 1986). It is important for the teacher to identify prerequisite skills needed for the task to be taught and for inclusion in a group, and then to assess these skills before beginning the group. Failure to do so may adversely influence the performance of other group members. Some students may need to be taught some prerequisite skills before becoming a group member.

Group arrangements. Groups may be organized in four different ways, intrasequential, intersequential, tandem, and 1:1 supplement (Brown, Holvoet, Guess, & Mulligan, 1980). First, in an intrasequential group arrangement, the teacher provides instruction to each member individually within the group setting without structuring any interaction between group members. For example, Wilson, Cuvo, and Davis (1986) taught meal planning skills to students with multiple disabilities. The teacher modeled for the entire group and then gave feedback to each individual student. Second, in an intersequential group arrangement, the teacher provides instruction and specifically structures or reinforces interactions between group members. Wolery, Ault, Gast, Doyle, and Griffen (1989) taught chained tasks to students with moderate handicaps in dyads. Students were prompted to provide attentional cues and reinforcement to each other. Third, in a tandem group arrangement, the teacher begins instruction in a 1:1 format and systematically increases the group size. Koegel and Rincover (1974) used a tandem group arrangement in teaching language skills to students with autism. Initially, two students were present in the group and the teacher systematically increased the group size until 8 members were present. And fourth, when a 1:1 supplement is used, the teacher provides instruction in one of the above group arrangements and then conducts 1:1 sessions to provide extra practice on the skill. A 1:1 supplement arrangement was used by Faw et al. (1981) in teaching manual signing to students with profound handicaps. Instruction occurred in a group, and students received 1:1 instruction when incorrect responses occurred during the group session. No comparisons of these types of group arrangements appear in the literature; thus, no empirically based recommendations exist for guiding the teacher in choosing the most effective and efficient arrangement. However, each has its advantages. An intrasequential group arrangement is the least complex type of arrangement and, therefore, it may be used with ease by teachers or teaching assistants who may be inexperienced in conducting group instruction. The use of an intersequential group arrangement would be useful for teachers who have a heterogeneous group population since peer tutoring interactions can be specifically structured. In addition, this arrangement may facilitate attention to task since group members are interacting with others in the group as well as being instructed on their own stimuli. The tandem group arrangement is ideal for teachers who have students who do not have the prerequisite skills to participate in a group or for students who are unfamiliar with group instruction.

By using the tandem arrangement, the teacher can form successful groups by systematically increasing the size of the group as students develop the necessary skills. The 1:1 supplement arrangement provides the teacher with increased flexibility since 1:1 instruction can be provided in addition to group instruction for those students who do not learn or whose learning is inefficient in a group.

Criteria for conducting a session. After teachers have made all of the decisions concerning group composition, they must establish the criteria of attendance to be used to hold the session. In other words, the teacher should decide how many of the students in the group should be present to conduct the instructional session. This decision is important for teachers but critical for researchers who are studying the efficacy of small group instruction, particularly if observational learning is under investigation (Bandura, 1971). For the teacher this is an arbitrary one that should be made prior to beginning instruction. If the teacher decides that all students must be present before the group will be held, then it is possible that many days may elapse without instruction for those students who are present at school. On the other hand, proceeding without group members may cause the students who are present to progress more rapidly than the absent student to the point where the absent student would not be able to successfully rejoin the group. In this case, the teacher may need to use a 1:1 supplement arrangement on the return of the absent student.

Another option would be for the teacher to use the days in which students are absent to review material with the present students and introduce new stimuli only when the entire group is present. When students are being taught different tasks and/or different stimuli, then more absences may be accepted than when students are being taught the same task and same stimuli. The teacher should determine in advance the criteria that will be used which will make the most efficient use of all members' instructional time.

What Procedures Will Be Used?

Once teachers have made all the necessary decisions concerning how the group will be formed, they are now ready to plan for instruction. This involves consideration of the instructional strategy, attentional cue, presentation of the discriminative stimulus, trial presentation, choral and individual responding, teacher consequences for student responding, and individual or group criterion.

Instructional strategy. One of the first decisions teachers should make is what specific instructional strategy will be used during small group instructional sessions (Wolery, Ault, & Doyle, in press). In determining the instructional method the teacher should consider the effectiveness of the strategy, the efficiency of the strategy, and the principle of parsimony. Effective instructional procedures that have been used in small group instruction include the system of least prompts (Doyle et al., 1989; Schepis, Reid, & Fitzgerald, 1987) prompt and fade (Fajardo & McGourty, 1983; Koegel & Rincover, 1974), error correction (Brown & Holvoet, 1982; Favell et al., 1978), progressive time delay (Browder, Snell, & Wildonger, 1988; Farmer, Gast, Wolery, & Winterling, 1989), and constant time delay (Gast, Wolery, Morris, Doyle, & Meyer, in press; Doyle, Gast, Wolery, Ault, & Farmer, in press). In determining the efficiency of each of the procedures, the teacher should consider variables such as the trials, sessions, instructional time, and errors to criterion, and the amount of additional observational information that is learned by students. Observational information refers to information not directly taught to a student, but that the student observes being taught to others. In addition, teachers should select instructional strategies on the basis of parsimony (Etzel & LeBlanc, 1979). This principle states that when two or more solutions are correct, then the simplest solution should be used. For example, the least complex strategy or the strategy with which the teacher is the most familiar should be used over other strategies. The effectiveness and efficiency of these instructional strategies have not been compared by researchers in small group arrangements, however comparisons have been made with 1:1 arrangements (Ault, Wolery, Doyle, & Gast, 1989). Data from these studies indicate that response prompting strategies (i.e., system of least prompts, time delay) were more effective and efficient in terms of errors to criterion than error correction strategies. Time delay procedures were more efficient in terms of trials, sessions, errors, and instructional time to criterion than the system of least prompts (Godby, Gast, & Wolery, 1987; Doyle, Wolery, Gast, Ault, & Wiley, in press). In addition, constant time delay is more parsimonious than progressive time delay since only one prompt delay interval is used. Although these comparison results are from 1:1 rather than group instructional arrangements, one might conclude that similar results would be found. Therefore, based on the effectiveness, efficiency, and the principle of parsimony, and given that students possess the necessary prerequisite skills, the constant time delay procedure may be the procedure of choice when determining an instructional strategy to use in a small group format. A more detailed review of instructional strategies within small group arrangements has been conducted by Gast, Doyle, Winterling, and Wolery (1989).

Attentional cue. When teaching in a group, the teacher may choose to use an attentional cue, that is some cue that precedes the delivery of the task direction or material presentation that ensures the attention of the student to the instructional stimuli. A general attentional cue can be used in which group members are simply asked to attend to the stimuli in general (e.g., "Eyes forward", "Look at this"), or a specific attentional cue can be used in which group members are required to attend to the relevant characteristics of the stimuli (e.g., students match the numeral before naming it, or calls the letters of the word in sequence before reading it). A specific and general attentional cue was compared by Alig, Wolery, and Gast (1988) in teaching sight word reading to a group of preschoolers with developmental delays. The general cue consisted of the teacher asking the student to look at the stimulus cards. The specific cue entailed the teacher saying the letter names of the words and requiring the students to repeat them prior to reading the word. Results indicated that students learned to read their target words regardless of the use of a general or specific attentional cue. Students were able to expressively read and receptively identify some of the other group members' words. This occurred most often for those words taught with a specific attentional cue rather than those taught with a general cue. When the goal of the group is to facilitate observational learning, the teacher may want to use a specific attentional cue. Regardless, some type of attentional cue is important for ensuring student attention during group instruction. The teacher also needs to decide if the attentional cue will be presented to only the student whose turn it is or to all members of the group on each trial. For example, Wolery et al. (1989) taught students with mild handicaps to read sight words. A specific attentional cue that was presented to the target student (i.e., only the target student responded) was compared to an attentional cue presented to all students at the same time (i.e., students responded chorally). The specific attentional cue consisted of the teacher orally spelling the word and the student repeating the spelling. Results indicated that no consistent differences across students were found between individual and choral attentional responses in terms of students' ability to read the target and observational words and spell target words. However, students consistently were able to spell more observational words taught with a choral attentional response than with an individual response. It is difficult to make a recommendation since this component of group instruction has not been studied extensively. Until more data are available, however, the teacher may want to deliver a specific attentional cue to all students since it is possible they may learn additional information that is presented in the cue, and attention to task may be facilitated. One should keep in mind, however, that specific attentional cues that require a student response is likely to slow the instruction and lengthen the session time.

Presentation of the discriminative stimulus. After delivery of the attentional cue, the teacher should now present the discriminative stimulus (S^D) or the signal for students to respond. With group instruction, the teacher should closely attend to how students are seated or positioned in the group. If an auditory S^D is used, the teacher must ensure that all students can hear adequately. Likewise, all students must be able to easily see the stimulus materials. Students should also be able to see and hear each other respond especially if stimuli can be learned through observation. Students should be positioned so that they are not too crowded, but close enough together so they do not have to strain to see, hear, or touch the stimuli if necessary. Some options that teachers can use to ensure optimal responding include seating students around a horseshoe-shaped table with the teacher seated on the opposite side of the table (Gast et al., in press); having students stand on the same side of a table while the instructor models motor responses on the table top (Wolery et al., 1989), presenting flashcards to the entire group (Doyle et al., in press), using a blackboard to present stimuli to all students (Boyer, 1987), and providing each student with their own set of materials if individual responses during the group are needed such as the use of "magic slate" boards or paper and pencil for writing tasks (Keel & Gast, 1989; Winterling, 1989).

<u>Trial presentation</u>. Following delivery of the task direction, the teacher now needs to decide how the trials will be presented. Decisions the teacher must consider include such things as predictable/unpredictable trial sequence, the number of trials presented per student, and the trial presentation format. First, if the teacher has students respond individually, a decision should be made whether trials will be presented so that students in the group can predict or not predict when they will receive a trial. Obviously, if the teacher presents trials in a round-robin fashion (e.g., always presents trials to students in order from left to right), some students may be able to

predict when it will be their turn. On the other hand, if the teacher randomizes trial presentation, students cannot predict when they will receive a turn. In a study conducted by Ault, Wolery, Gast, Doyle, and Martin (1988), students with mild handicaps were taught to read words under two conditions; a predictable trial presentation condition was compared to an unpredictable trial presentation condition. Resultsindicated that no substantial differences between the two conditions occurred in terms of attention to task and students' ability to read observational words. Predictable and unpredictable trial presentations have not been compared with students with moderate or severe handicaps. Until more data become available on this component of group instruction, teachers may want to use an unpredictable trial sequence since it may help facilitate attention, thereby enhancing acquisition and observational learning. On the other hand, if predictable trial presentation formats are easier to implement for the teacher, they should be chosen. Until more research is conducted, teachers should present trials based on personal preference and analyze the effects with their own students.

Second, the teacher should decide how many trials will be presented each session. This should include the number of trials each individual student will receive and/or the number of trials for the entire group. If students respond individually during the session, the session length will naturally increase as the number of trials presented to each student increases. In addition to determining the number of trials, the teacher should decide if the number of trials will be constant or variable across instructional sessions. Four possible ways that trials can be manipulated during sessions are presented in Table 1. Of these, constant trial presentations may be the easiest for a teacher since the teacher always delivers the same number of trials to each student and summarizing the data is also simplified. Variable trial presentation, although slightly more complicated, gives teachers flexibility during instruction. Examples of variable trial presentations may occur when a teacher (a) chooses to present extra trials to a student who makes an error or needs extra help (Faw et al., 1981; Gaylord-Ross, Forte, Storey, Gaylord-Ross, & Jameson, 1987), (b) teaches skills that are variable by their nature (i.e., the number of trials presented during a grocery shopping activity is dependent on the number of items on the shopping list) (Gaule, Nietupski, & Certo, 1985), and (c) sets a time limit on a session causing the number of trials to vary (Browder et al., 1989).

Constant and variable number of trials within and across sessions in small group instruction

	CONSTANT WITHIN SESSIONS	VARIABLE WITHIN SESSIONS
CONSTANT ACROSS SESSIONS	Each student in the group receives the same number of trials during a session and that number of trials is used every session.	Each student in the group receives a different number of trials, but the number of trials received remains the same each session.
VARIABLE ACROSS SESSIONS	Each student in the group receives the same number of trials during a session, but the number of trials used changes each session.	Each student in the group receives a different number of trials, and the number of trials received changes each session.

Third, the trial presentation format should be selected. Trials can be presented in a massed, spaced, or distributed format (Mulligan, Guess, Holvoet, & Brown, 1980). For purposes of this manuscript, massed trials are defined as each student receiving trials that occur so closely together that no behavior can be expected to occur between them. Massed trials have an intertrial interval of less than 10 seconds. Use of massed trials was reported by Brown and Holvoet (1982) in teaching clerical skills to adolescents with profound handicaps. The teacher presented three massed trials to one student on his targeted behaviors before presenting three massed trials to the next student. Spaced trials refer to trials that are presented so that an individual student has a rest period, pause, or noninstructional activity that occurs between trials from the same program. The intertrial interval is equal to or greater than 10 seconds. Fajardo and McGourty (1983) used spaced trials in teaching social/leisure skills to a group of students with moderate, severe, or profound handicaps within the context of playing a table-top game. Students received trials when their turn naturally occurred in the game. Distributed trials refer to an individual student receiving trials on one or several different skills between trials from the same program. Writing skills were taught in this format to a group of elementary students with learning disabilities (Stromer, 1977). Students worked on specific writing assignments with trials presented only at intervals when a letter reversal occurred.

To present trials in a massed trial format, the teacher can use choral responses from the students or deliver massed trials in sequence to individual group members. Teachers may choose to deliver massed trials using choral responding if their students perform better with fast-paced instruction or are not able to wait appropriately between trials. When all students are learning the same target behaviors, massed choral responding can decrease the session length. Massed trial formats can also be used in which the teacher chooses to present several trials to one student before presenting trials to another student. This may increase the session length and the length of time a student must wait for a turn to respond, but it allows the teacher to present different target behaviors to each student, thus, creating an opportunity for observational learning to occur. Finally, massed trials may offer a format for teachers to present repeated corrective trials to an individual student following an error.

Spaced trials can also be delivered using either a choral response from all students or an individual response from each student in the group. Several advantages exist when using spaced trials. First, the teacher has an amount of intertrial time available to rearrange materials for the next trial or to allow students time to consume reinforcers. Also, when students are responding individually, observational learning opportunities are created as students watch each other take turns. Teachers may be the most familiar with this format since it is probably the most widely used group arrangement implemented in classrooms.

The distributed trial presentation format has not been widely used in small group instruction in the research literature, however, it does present several advantages for the teacher. A teacher who is teaching functional skills may find that distributed trials are a good option since these skills usually occur during the natural routine of the day. For example, students are usually required to wash hands before lunch and after each bathroom visit. The teacher may choose to teach this skill during those times. Some additional planning time may be involved in distributed trial format since the teacher must identify times during the day when instruction on a naturally occurring event can take place for several students at the same time. If the teacher chooses to use a distributed trial format during a single session, several target behaviors will be taught. For example, students may receive distributed trials of name-writing interspersed with instruction on another content area. The teacher may need to explore various ways of using distributed trials due to limited research regarding the use of this format in small groups. It is possible that the distributed trial format may prove to be the most natural way to teach during the school day and may be especially useful in facilitating generalization.

In operationalizing the use of massed, spaced, or distributed trials, the teacher may choose a combination of these formats. For example, some teachers may choose to begin with massed trials and then deliver distributed trials during a generalization phase of instruction. The choice of one format over another is an arbitrary decision to be made by the teacher depending upon the success of the students in the classroom with each format.

Choral and individual responding. An important variable to consider when designing group instruction is how the teacher will have the students respond. Students can respond in unison (i.e., chorally) or individually while the other students watch. Few research studies have investigated the use of choral versus individual responding as a component of groups. However, Sindelar, Bursuck, and Halle (1986) did compare a choral with an individual response in teaching sight word reading to students with mild handicaps. The results indicated that choral responding resulted in the students learning more words, even though the difference between the two responding conditions was minimal.

If the teacher chooses to use choral responding, all students in the group would be learning the same stimuli, so opportunities for observational learning would not be present. During sessions using choral responding, students are always actively involved and the opportunities for each student to respond are increased. Of course, the teacher must at some time test students individually to determine mastery of skills (Heward, Courson, & Narayan, 1989). If the teacher chooses to have students respond individually, there will be times during each session in which each student is not actively involved. If students are learning different stimuli, they will have the opportunity to learn non-targeted information by watching the other members of their group.

Consequences for responding. To keep students motivated to respond and to give them feedback on the correctness of their response, teachers should plan what consequences will be delivered following each type of student response. The teacher may choose to deliver verbal feedback only, or verbal feedback plus individual reinforcers identified for subjects (e.g., activity, tangible, edible). These consequences may be delivered following each correct response or at the end of an entire session and to the target student only or to the entire group. Likewise, the teacher should plan consequences for incorrect responses or for failure to respond. The teacher can ignore the error (i.e., say nothing), provide a mild reprimand (i.e, say "No," or "Wrong"), model the correct response, model the correct response and have the target student repeat it, model the correct response and have the entire group repeat it, provide massed trials on the stimuli receiving the error, conduct a brief in-seat time-out (e.g. 10 seconds), or use a combination of two or more of these consequences. Since comparisons have not been made on the preferred consequence to use following correct and incorrect responses, teachers should rely on their best judgment concerning the consequences they will use. Group instruction provides an advantage over teaching students in a 1:1 format in that students can observe the consequences delivered to their peers for correct and incorrect responses; this may positively affect their own responding.

Individual and group criterion. As with all instruction, the teacher needs to decide what criterion will be used to determine when students have mastered a skill. In group instruction, the teacher can decide to set an individual or a group criterion. When an individual criterion is used, each student receives instruction on a behavior until s/he meets the set criterion. For example, Krantz, Zalenski, Hall, Fenske, and McClanahan (1981) taught verbal and written language skills to students with autism. When a student attained 90% accuracy, the difficulty of the task was increased for that student. In contrast, when a group criterion is used, all members of the group must meet the criterion as a unit before the skill is considered mastered. Fajardo and McGourty (1983) taught students with mild to profound handicaps to play a game using a group criterion. All students were required to receive three correct unprompted responses on the game before a new game was introduced to the group. When the teacher uses an individual criterion, there are both advantages and disadvantages. Students in the group are allowed to progress at their own pace and more information can be taught to these students that learn faster than other members of the group. Alternatively, observational learning may be minimized since the number of trials presented on each stimulus varies depending upon the acquisition rate of the student. The management of an individual criterion may also be more difficult since the teacher must closely monitor when each student meets criterion and change stimuli accordingly. In addition, some students may be receiving instruction on a continuous reinforcement schedule while some are on a variable reinforcement schedule; still others may be receiving probe or baseline trials. This all adds to the complexity of using an individual criterion. Group criterion, on the other hand, is less complex since all students remain on the same reinforcement schedule and learn the same task until everyone meets criterion. Some tasks naturally lend themselves to group criterion. For example, tasks such as game playing or vocational skills may be dependent upon the participation of all students in the group in order for the task to be completed. Although observational learning may be facilitated by using a group criterion, students who progress faster than other members of the group may receive repeated trials on a task they have mastered, thus deterring them from learning additional information. Teachers should decide, based on the characteristics of the group members, the size of the group, the task being taught, and their experience in group instruction, which criterion will best enable their students to meet with success.

How Will Learning Be Measured?

When designing instructional programs, the teacher should measure if students are learning with the chosen procedures, how well they are learning, and if they are able to use the information learned outside of the specific training setting and procedures.

Effectiveness measures. Obviously, the most important variable to measure in any type of instructional program is how effectively each individual member of the group learns individual target behaviors. Researchers have collected these data in similar ways including: pre-and post-test measurement (Livi & Ford, 1985), trial-by-trial recording (Gast et al., in press), or through the use of permanent products (Stromer, 1977). Teachers can collect data during small group instruction for each individual member and/or for the entire group. It is recommended that the teacher ensure that data on the performance of individual members are collected regularly in order to make sure that all members of the group are progressing. Data sheets that can be used by the teacher during small group instruction are included in Appendix A. To demonstrate the effectiveness of the intervention being used, teachers may wish to evaluate student learning by using an experimental design (Tawney & Gast, 1984), and at the very least should collect baseline data prior to implementing the intervention (e.g., AB design). Experimental designs that have been used by researchers include: an AB design (Storm & Willis, 1978), multiple probe design (Farmer, et al. 1989), and multiple baseline design (Brown & Holvoet, 1982).

Efficiency measures. Throughout group instruction, other measures can and should be collected. Teachers should collect efficiency measures to determine how well students are learning with the procedures and to determine which procedures make the best use of teacher and student time. For example, the teacher can measure how efficiently students learn a target behavior in terms of the number of sessions

(Marchetti et al., 1984), trials (Oliver & Scott, 1981), errors (Singh, 1987), and minutes of instructional time (Kohl, Wilcox, & Karlan, 1978) to criterion. Another way to measure efficiency is to evaluate whether students learn additional information during the use of group instruction. That is, students may not only learn target information, but information being taught to other members of the group (i.e., observational learning) as well. If this occurs, the teacher's time has been well spent since students have learned information without direct teacher instruction. For example, when teaching students with moderate handicaps to read words, Singh (1987) compared individual with group instruction. During instruction, each student read a different passage in a book. Results indicated that following group instruction, students were able to read some of the words taught to the other members of their group. Teachers should collect efficiency data on several of their instructional programs so that comparisons can be made regarding which of the programs makes the most efficient use of both teacher and student time.

Summarizing data. As with all instruction, data should be summarized using measures such as percent of correct responses, number of steps completed correctly, etc.. It is always important to graph data so that a visual representation of the data is continually available which allows the teacher to quickly recognize when a change in the program is needed. Data for each group member as well as the entire group should be collected (Franzini, Litrownik, & Magy, 1980) and graphically displayed. When the data from the entire group are summarized, the teacher must calculate a mean of all group members' responses. While it is necessary to have individual graphs to monitor the performance of each student, group graphing is useful when a group criterion is used, for public posting, for monitoring group contingencies, and for comparing group data in order to make instructional decisions (Westling et al., 1982; Franzini et al., 1980). Appendix B contains examples of data in which the performance of the group is graphed or summarized.

Generalization and maintenance. Generalization and maintenance measures should also be collected to ensure that students can use the skills they have learned in novel situations and maintain them over time. Evaluation of these data will indicate if further programming is necessary. To assess how well students can use what they have learned in other environments, the ability of students to use their acquired behavior should be measured in the presence of other people (Krantz et al., 1981), in other settings (Keogh, Faw, Whitman, & Reid, 1984; Krantz et al., 1981), and with other materials or tasks (Handleman & Harris, 1983; Krantz et al., 1981). Maintenance checks can be collected after a specified number of sessions, days, weeks, or months. The research literature most frequently reports maintenance checks collected at 2 week intervals (Collins & Gast, 1988).

How Will Group Behavior Be Managed?

The teacher needs to plan before the first group session is held, how inappropriate behaviors of students will be systematically managed if they occur during the instructional session.

Group contingencies. To ensure that students in the group demonstrate appropriate behaviors, the teacher should have a plan for managing inappropriate behaviors that may occur. Independent, interdependent, or dependent group contingencies are all options the teacher may want to consider (Kerr & Nelson, 1989; Litow & Pumroy, 1975). First, independent group contingencies refer to those contingencies in which students receive reinforcement based on their own behavior. For example, when Krantz et al. (1981) taught a group of elementary students with autism to describe objects, tokens and points were delivered on an individual basis when students sat quietly while others responded. Second, interdependent group contingencies refer to those contingencies in which all students receive reinforcement based on a specified level of group performance. This might include all group members individually reaching a set criterion or the average of all group members' performance meeting a set criterion. An interdependent group contingency was used by Gersten and Maggs (1982) in teaching language and reading skills to students with moderate handicaps. All students were required to attend and respond before receiving a token and progressing to a new task. Third, dependent group contingencies refer to those contingencies in which all students in the group receive reinforcement based on the performance of one or more selected group members. Winterling (1989) taught word reading to a group of students with mild handicaps. On the average of every third trial, one student was randomly selected and scored as attending or not attending. If the student was attending, s/he earned one penny for the entire group. At the end of the session if an adequate number of pennies had been earned, these pennies were traded for a back-up reinforcer for all members of the group.

Group contingencies can be used by the teacher to facilitate appropriate social behaviors in the group and/or to facilitate attention to task during the group session. Teachers should assess group members for appropriate social and attentional behaviors when deciding if a group management contingency will be needed. Independent group contingencies may be used by teachers if they prefer to reinforce each student based on individual behavior. This contingency, however, does not structure any interactions between the members. If an individual student is especially disruptive (e.g., responds out of turn, hits, kicks, refuses to participate, inappropriately socializes with others), specific contingencies should be developed for that individual. This may include reinforcing students for appropriate attending, ignoring the inappropriate behavior, reinforcing others for appropriate behavior, issuing a warning, providing an in-seat time-out procedure, using a response cost procedure, or removing the student from the group. With an interdependent contingency, some group interaction takes place. Teachers may choose to use this contingency if they desire to develop group interaction skills, although it is possible that some students may be penalized for the inappropriate behaviors of others. Dependent contingencies may also be used when group interaction is important. This may be especially useful when only one or two students in the group are not attending or are behaving inappropriately. The teacher runs the risk of putting undue pressure on those students, but this risk may be outweighed by the social reinforcement students will receive from the other group members for appropriate behaviors. There are no "hard-and-fast" rules for the most appropriate contingency to use. Teachers should make a decision based on their own experience and the student characteristics of the group.

Discussion

Since an adequate amount of research has not been conducted on all components of group instruction, many of the decisions made by teachers must be based on their own judgment and experience. The purpose of this manuscript was to make teachers aware of the decisions that need to be made when designing group instruction and to provide recommendations based on an analysis of current "best practice" methodology and the research literature, when possible. Because group instruction provides several advantages over individual instruction to both teachers and students, it is worthy of consideration as a viable format to use in the classroom. It is important for teachers to consider each of the components involved in conducting group instruction and to systematically implement group instructional programs to ensure the success of their students. A checklist, for use by teachers when designing group instruction, that summarizes these components is included in Appendix C.

Future research should be conducted to assess the best means of conducting instruction in small group formats. Comparison studies of the components of group instruction should be conducted to determine the most effective and efficient way to conduct small groups. Until this research has been conducted, teachers should select group components based on the recommendations of this manuscript and their own experience with what is the most useful for them and the most effective with their students. They should then incorporate the findings of research into their daily practice as data become available.

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APPENDIX A

GROUP DATA SHEETS

This is an example of a data sheet to be used during instruction of a group of 4 students. This data sheet can be used with several instructional strategies such as error correction, model-lead-test, most-to-least prompting, prompt and fade, and system of least prompts. When using error correction or model-lead-test, the teacher would simply indicate student responses with a "+" for correct responses, a "-" for incorrect responses, or a "0" for no responses. For procedures such as most-to-least, prompt and fade, and system of least prompts, the teacher would record the prompt level that was required for the student to emit a correct response for each stimulus or step in the task analysis.

Group Data Sheet

Instructor ____________ Strategy ________________ Condition ________________

Start time __:__ Stop time __:__ Total Time ___min ___sec Behavior ________________

Observer __________ Reliability % _____ Session ___ Date ___

TRIAL	S1		S2		S3		S4	
	Stimulus Task Analysis	S.Responding	Stimulus Task Analysis	S.Responding	Stimulus Task Analysis	S.Responding	Stimulus Task Analysis	S.Responding
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
SUMMARY DATA								
	SUBJECT		SUBJECT		SUBJECT		SUBJECT	
	Corrects		Corrects		Corrects		Corrects	
MEAN %	Incorrct		Incorrct		Incorrct		Incorrct	
	NoRespns		NoRespns		NoRespns		NoRespns	

This data sheet is designed specifically to be used with a system of least prompts procedure when the teacher is instructing 3 students. The teacher fills in the students' names in the order in which trials will be presented and then checks what prompt level was needed for the student to respond correctly on each trial.

SYSTEM OF LEAST PROMPTS GROUP DATA SHEET

Teacher:________________ Session:______________ Date:___/___/___

Condition:_____________ Strategy: ______________________

Start time ___:___ Stop time ___:___ Total time ___:___

Trial	Student	Stimulus	Indep	Prompt 1	Prompt 2	Prompt 3	Prompt 4
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

SUMMARY DATA

JIM	Indep	Prompt 1	Prompt 2	Prompt 3	Prompt 4
	N=	N=	N=	N=	N=
	%	%	%	%	%

TAMMY	Indep	Prompt 1	Prompt 2	Prompt 3	Prompt 4
	N=	N=	N=	N=	N=
	%	%	%	%	%

ELLEN	Indep	Prompt 1	Prompt 2	Prompt 3	Prompt 4
	N=	N=	N=	N=	N=
	%	%	%	%	%

GROUP MEAN	Indep	Prompt 1	Prompt 2	Prompt 3	Prompt 4
	N=	N=	N=	N=	N=
	%	%	%	%	%

This data sheet is designed to be used with a group of students who are being taught a discrete task with a time delay procedure. The teacher fills in the students' names in the order in which trials will be presented and then indicates if a correct, incorrect, or no response occurred before or after the prompt.

INSTRUCTOR__________ SESSION______ DATE___/___/___.

CONDITION____________ STRATEGY____________

START TIME___:___ STOP TIME___:___ TOTAL TIME___:___

Trial	Student	Stimulus	Delay Interval	Student Responding BEFORE	AFTER
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

SUMMARY DATA

JOE	#/% Corrects		
	#/% Incorrects		
	#/% No Response		
MARY	#/% Corrects		
	#/% Incorrects		
	#/% No Response		
STEVE	#/% Corrects		
	#/% Incorrects		
	#/% No Response		
JOHN	#/% Corrects		
	#/% Incorrects		
	#/% No Response		
GROUP	#/% Corrects		
	#/% Incorrects		
	#/% No Response		

KEY: + = correct, - = incorrect, 0 = no response

To teach a discrete task using a time delay procedure, the teacher may choose this data sheet. This sheet can be used with 5 subjects. The teacher places the students' names across the top of the sheet and indicates if a correct, incorrect, or no response occurred before or after the prompt.

TIME DELAY GROUP DATA SHEET

Instructor ____________ Strategy ______________ Condition ____________ Session ____ Date ______

Start time ___:___ Stop time ___:___ Total Time ____min ____sec Behavior ____________________

DELAY _____ Observer __________ Reliability % _____

TRIALS	S1			S2			S3			S4			S5		
	Stimulus	Before	After	Stimulus	Before	After	Stimulus	Before	After	Stimulus	Before	After	Stimulus	Before	After
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

SUMMARY DATA

	Corrects	Before	After	Corrects	Before	After	Corrects	Before	After	Corrects	Before	After	Corrects	Before	After
MEAN	Incorrct	Before	After	Incorrct	Before	After	Incorrct	Before	After	Incorrct	Before	After	Incorrct	Before	After
%															
	NoRespns	Before	After	NoRespns	Before	After	NoRespns	Before	After	NoRespns	Before	After	NoRespns	Before	After

KEY: + = correct; - = incorrect; 0 = no response

A chained task can be taught using the time delay strategy with this data sheet. This particular data sheet is used when teaching in dyads with one student observing while the other is being instructed. The teacher indicates if a correct, incorrect, or no response occurred before or after the prompt for each step of the task analysis.

TIME DELAY DATA SHEET

Student__________ Instructor ______ Date______ Session___ Observer_______

Start time ______ Stop time ______ Total time __ min __ sec

Delay_____ Task________________________ Condition/Phase_________

TASK ANALYSIS		BEFORE	AFTER	COMMENTS
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
SUMMARY DATA	Corrects	#= %	#= %	
	Incorrects	#= %	#= %	
	No Response	#= %	#= %	

Student_________ Delay_____ Task________________________

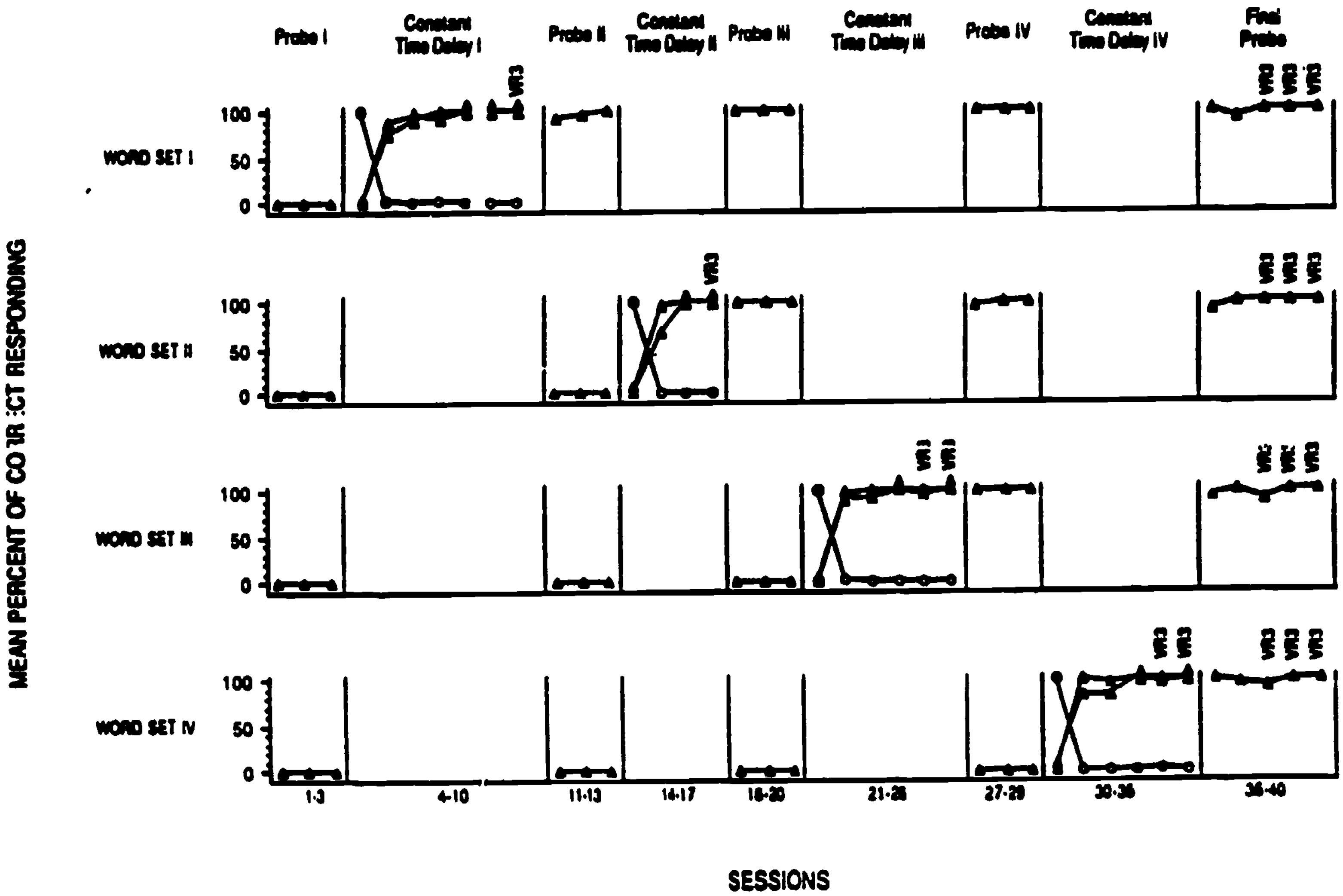
TASK ANALYSIS		BEFORE	AFTER	COMMENTS
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
SUMMARY DATA	Corrects	#= %	#= %	
	Incorrects	#= %	#= %	
	No Response	#= %	#= %	

Key: + = correct; - = incorrect; 0 = incorrect; T = topography;
D = duration; S = sequence

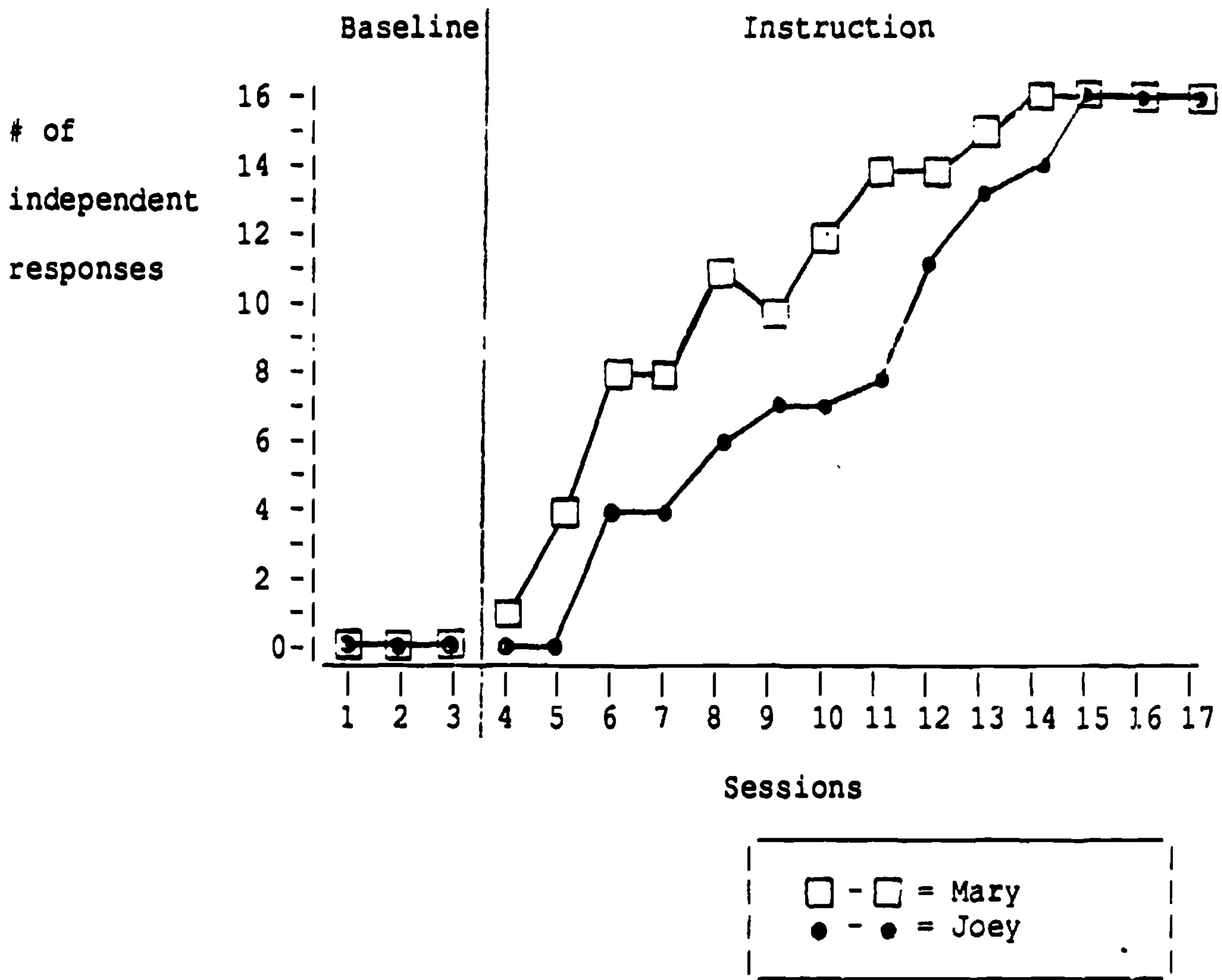
APPENDIX B

VISUAL PRESENTATION OF DATA

This line graph displays the mean performance of a group of students involved in a time delay instructional program. The closed triangles represent the group's mean performance on daily probes. Open triangles represent the mean percent of unprompted correct responses and open circles represent the mean percent of prompted correct responses during time delay training. This graph would be an appropriate display when a group criterion is used.



Another visual display of group data can be accomplished by plotting individual students' data on the same graph. Each student's data is represented by a different symbol. This allows the teacher to be able to monitor each student's individual performance while at the same time being able to monitor how each member of the group is progressing compared to the other members. This type of graph should probably not be used with more than 2-3 students since more than 2-3 symbols on the same graph could be confusing. This graph would be an appropriate display when a group or individual criterion is used.



An adaptation of a cumulative charting system can be used to monitor the performance of a group of students. The mean percent of correct responses on which the students in the group performed on steps of the task analysis is recorded. This charting system would be appropriate only when a group criterion is used.

Task Shirt folding Members of group Joe, Pam, Heloise

Instructor P. S.

4. Grasp/fold in thirds.							/	T/20	T/50	T/80	T/80	T/100
3. Grasp/fold in thirds.					/	T/60	T/100	X	X	X	X	X
2. Grasp/fold top to bottom.	/		/	T/50	T/100	X	X	X	X	X	X	X
1. Place shirt in basket.	T/20	/75	T/100	X	X	X	X	X	X	X	X	X
Session/Date	1	2	3	4	5	6	7	8	9	10	11	12

T = training in progress, X = assessed, criterion met, / = assessed, criterion not met, 0-100 = mean % of correct responses

APPENDIX C

CHECKLIST OF COMPONENTS OF GROUP INSTRUCTION

Checklist of Components of Group Instruction

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
Group Composition	
How many students will be in the group?	
How will the group be composed in terms of age?	Homogeneous or Heterogeneous
How will the group be composed in terms of diagnosis?	Homogeneous or Heterogeneous
Will the same or different task(s) be taught to each student? List the specific tasks.	Same or Different
Will the same or different stimuli be used with each student? List the specific stimuli.	Same or Different
List the specific entry skills needed by each student to participate in the group.	
How will the group be organized?	Intrasequential, Intersequential, Tandem, or 1:1 supplement
How many students must be present in order to conduct the group session?	
Instructional Procedures	
What is the specific instructional strategy that will be used to teach the tasks?	
What type of attentional cue and response will be used?	None, Specific, or General

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
Who will be required to give an attentional response?	Target student or All students
Describe the specific attentional cue and that will be used.	
How will the S^D be presented to the group? (Consider auditory/visual presentation, physical setting, materials)	
How will trials be sequenced?	Predictable or Unpredictable
How many total trials will be delivered in the session?	
How many trials will be delivered to each student during a session?	
How many trials will be delivered to each student each time it is his/her turn to respond?	
What trial presentation format will be used?	Massed, Spaced, or Distributed
How will the group members respond on target stimuli?	Chorally or Individually
Specifically, what will the teacher do following:	
Correct responses?	
Incorrect responses?	
No Responses?	
Will an individual or a group criterion be used?	Individual or group
What is the specific criterion?	

COMPONENT OF GROUP INSTRUCTION	TEACHER RESPONSES (Write or circle)
Measurement and Evaluation	
What type of data will be collected to determine if students are learning?	Pre- Post- testing, Trial-by-trial recording, Permanent products, Other
What experimental design will be used?	AB, Multiple probe, Multiple baseline, Other
How will the teacher monitor how well students are learning?	Number of sessions to criterion, Number of trials to criterion, Number/percent of errors to criterion, Minutes of instruction time to criterion, Other
How will student response data be summarized?	Line graph, Table, Cumulative chart, Other
How will generalization by assessed?	Across persons, Across setting, and/or Across materials, Other
How frequently will maintenance data be collected?	
Group Management	
What type of contingency will be used to manage group behavior?	Independent, Interdependent, Dependent, or None

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Table of Contents

Effective and Efficient Small Group Instruction: The Use of Constant Time Delay

Vincent Winterling, David L. Gast, Patricia M. Doyle, Mark Wolery

Introduction

Teachers should give careful attention to the acquisition of new behaviors when providing instruction to students with disabilities. Teaching new behaviors requires decision-making by teachers on at least two levels. First, teachers must prepare for instruction. They decide the type of behavior to be taught, the number of target behaviors, and the number of students who will be taught. For example, a teacher may decide that she will teach an academic behavior such as sight word recognition to three to four students in a small group instructional arrangement, or to teach photograph identification to one student in a one-to-one arrangement. Second, once teachers identify the target behaviors and arrange the instructional format, they must decide how to teach the behaviors by selecting an instructional strategy. Wolery, Ault, Doyle, and Gast (1986) define an instructional strategy as a systematic approach for providing instruction that addresses what occurs before and after a student responds. A teacher's decisions in preparing for instruction and selecting an instructional strategy should be based on measures of effectiveness (e.g., Has the student learned a new behavior when taught with a particular instructional strategy?), and efficiency (i.e., Will the use of a particular small group instructional arrangement free the teacher to train additional skills that she might have otherwise been unable to teach?).

The purpose of this paper is to describe the use of the constant time delay procedure in small group instructional arrangements. It is a "how-to" guide for using the constant time delay (CTD) strategy, with students of varying ages and ability levels, in small groups. First, a rationale for the use of group instruction for students with disabilities is presented; followed by a description of the constant time delay procedure. Finally, the procedure is illustrated within the context of small group instruction.

Rationale and Supporting Research

Historically, decisions regarding whether to teach students in small groups or in one-to-one contexts were dependent on the clinical judgement and professional preparation of the classroom teacher. The teacher assessed the "readiness" skills of the students and the types of behaviors to be taught and made a decision. The prevailing zeitgeist and an absence of research tended to support the notion that students with mild handicaps could participate in small groups while students with more severe handicaps were best instructed in one-to-one arrangements.

Recently, however, an emerging research base has provided support for the use of small group instructional arrangements for students with more severe handicaps. This support has come from two sources. First, a number of studies involving students with moderate and severe handicaps which compared one-to-one instruction to small group instruction have found that effective learning can occur in small group arrangements (Favell, Favell, & McGimsey, 1978; Oliver & Scott, 1981; Storm & Willis, 1978; Westling, Ferrell, & Swenson, 1982). Second, several studies have found that group instruction has been effective in teaching language and academic skills to students with severe handicaps (Oliver, 1983), moderate handicaps (Doyle, Gast, Wolery, Ault, & Farmer, 1990; Gast, Wolery, Morris, Doyle, & Meyer, in press) and expressive language skills to preschoolers with various developmental delays (Cybriwsky, Wolery, & Gast, in press). Group instruction has also been used to teach tasks in other skill domains. For example, Wolery, Ault, Gast, Doyle, & Griffen (1989) taught pairs of primary-aged students with moderate delays domestic and vocational skills, while Schoen and Sivil (1989) taught self-help skills to pairs of preschoolers with developmental delays. Based on the results of the aforementioned studies, it is clear that small group instructional arrangements represent a viable alternative to one-to-one instruction for many, if not most students with moderate and severe handicaps.

While a number of investigations have demonstrated the effectiveness of small group instruction, some investigators have suggested that small group instruction also increases the efficiency of classroom instruction in several ways (Brown & Holvoet, 1982). First, small group instructional arrangements may increase the probability that students will generalize skills (Brown, Holvoet, Guess, & Mulligan, 1980). Second, small groups can be a more efficient use of teacher time, that is, the teacher is able to provide additional direct instruction of target behaviors to more students (Brown et al., 1980; Fink & Sandall, 1980; Smith & Meyers, 1979; Snell, 1983; Storm & Willis, 1978). Third, small group instruction provides the opportunity to increase the amount of information acquired by students through observational learning. For example, several recent investigations have shown that group members will acquire their own target behaviors and some of the target behaviors taught to their peers (Doyle et al., 1990; Farmer, Gast, Wolery, & Winterling, 1990; Gast et al., in press; Shelton, Gast, Wolery, & Winterling, in press; Winterling, 1990). The interpretation of these findings suggest that by programming for observational learning it may not be necessary to provide direct instruction on all target behaviors.

Description of the Constant Time Delay Procedure

The previous discussion suggested that small group instructional arrangements are a viable alternative to one-to-one instruction when teaching new skills to students with disabilities. The decision to use a small group arrangement, however, does not preclude the individualization of instruction or the use of systematic instructional strategies (Brown et al., 1980). The use of a near-errorless response prompting procedure, constant time delay, is an example of a systematic instructional strategy that can be easily implemented in small group instructional arrangements.

In the constant time delay procedure, the teacher delivers both a task direction (i.e., information that tells the student to respond, such as "What word is this?" or the printed word in context), and a controlling prompt (i.e., information that ensures that the student will respond correctly, such as the teacher verbally modeling the correct response). Initially, the task direction and the prompt are presented to the student at the same time. These instructional trials are called zero-second delay trials because the teacher does not allow the student the opportunity to respond before the prompt is delivered. For example, Ms. Andrews is teaching Barry to identify kitchen utensils. She presents the task direction "Find the spatula," and immediately points to the spatula in the kitchen drawer. Because Ms. Andrews has identified a controlling prompt for Barry (i.e., a point), she knows that Barry will respond correctly when she points to the spatula. However, because she wants Barry to find the kitchen objects without her assistance, Ms. Andrews begins to "fade" her prompt after a predetermined number of zero-second teaching trials. This is accomplished by inserting a specified amount of time between the task direction and delivery of the prompt. This type of instructional trial is referred to as a delay-trial because it allows the student time to respond before assistance is delivered. For example, Ms. Andrews presents the task direction, "Find the spatula" but now she waits four seconds for Barry to respond before pointing to the correct object as she counts silently to herself, "one-one thousand, two-one thousand, three-one thousand, four-one thousand" etc. She continues to wait the same amount of time on all remaining instructional trials; that is, the time inserted between the task direction and the prompt stays "constant" until Barry consistently finds the kitchen utensil before the prompt is delivered.

Five different responses are possible when using the constant time delay procedure. There are two types of correct responses and three types of incorrect responses. An unprompted correct response or "anticipation" occurs when the student responds correctly during the delay interval that has been inserted between the task direction and prompt. A prompted correct response or "correct wait" is defined as the student waiting silently for the prompt if he does not know the correct answerand then responding within a reasonable amount of time after the prompt has been delivered. Although the objective of the constant time delay procedure is to teach the student to respond correctly before delivery of the controlling prompt, both types of correct responses (i.e., unprompted and prompted) should be reinforced during instruction. However, only unprompted correct responses count toward criterion. If the student responds incorrectly before the teacher has the opportunity to deliver the prompt, then the student has made an unprompted incorrect response or "non-wait" error. An incorrect response made after the delivery of the controlling prompt is a prompted incorrect response or "wait" error. Finally, a no-response error occurs when the student does not respond within a reasonable time following delivery of the prompt. The consequences that follow each type of correct or incorrect response are dependent upon the characteristics of the student and the target behavior. Descriptive praise and a tangible or token reinforcer frequently are provided for correct responses. Incorrect responses may be corrected, ignored, or the student may be reminded to wait for teacher assistance if he doesn't know the correct response.

Constant time delay has been used to teach a wide variety of skills to persons with a variety of learning handicaps (e.g., Ault, Gast, & Wolery, 1988; Browder, Morris, & Snell, 1981; Schoen & Sivil, 1989; Stevens & Schuster, 1987). Constant time delay has been shown to be effective in teaching receptive, expressive, and signed language tasks (Ault, Gast, Wolery, Doyle, & Eizenstat, 1988; Browder et al., 1981; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Kleinert & Gast, 1982; Wolery, Gast, Kirk, & Schuster, 1988), and functional adaptive behavior skills, including banking (McDonnell & Ferguson, 1989), bedmaking (Snell, 1982), sandwich-making (Schuster, Gast, Wolery, & Guiltinan, 1988), and self-help skills (Schoen & Sivil, 1989).

In summary, the constant time delay procedure has been effective and efficient in teaching different types of responses in near-errorless fashion in small group instructional arrangements. For example, it can be used to teach discrete behaviors; that is, behaviors that consist of a single response. Discrete responses might be receptive tasks such as Barry pointing to the spatula in the drawer, or as an expressive behavior, such as a student reading a community-referenced sight word. The constant time delay procedure also can be used to teach complex skills which have been task analyzed (i.e., chained tasks). In the section that follows several small group instructional programs which use the constant time delay procedure are described. The first program describes how to teach a discrete receptive response to three students during a small group instructional arrangement. In the second program, we describe how to teach an expressive sight word recognition task within the context of a group. In the third program, teaching a chained task in a small group instructional arrangement is described. In each instructional program the critical decisions facing the teacher are outlined, followed by a description of the way in which the constant time delay instructional trials are presented. Each program is accompanied by a sample data collection sheet to record students' responses.

Teaching a Receptive Task to a Group of Students using a Constant Time Delay Procedure

Select the students and identify the target skill. Three students, all female, were selected from a classroom for preschoolers with moderate mental retardation. The three girls, Carrie, Jessica, and Maria ranged in age from 3 years-3 months to 4 years-6 months. Each student was able to sit at a table for a period of 10 minutes without engaging in disruptive behaviors, make eye contact with the teacher, follow simple verbal directions, and imitate gestures. All students previously had received systematic instruction in one-to-one teaching contexts. The students could not receptively identify photographs of common objects found in their environments. The speech pathologist suggested that this was an important behavior for later language development. The teacher, Mr. Juarez, did not have time to conduct one-to-one instructional sessions with each of the three students so he decided to implement a small group teaching activity in which he would teach the three students to identify two objects depicted in photographs.

Planning the small group instructional program. After Mr. Juarez identified the students and decided which skill he would teach, he made several other decisions to ensure the successful implementation of the instructional program. These included: (a) deciding whether to use a predictable or unpredictable trial sequence, (b) whether to have students respond individually or chorally, (c) selecting the photographs to teach and the number of trials per photograph, (d) ensuring student attention throughout the instructional session, (e) specifying consequences for student responses, (f) identifying a controlling prompt, (g) selecting the time delay interval and the number of zero second delay sessions, and (h) establishing a reasonable criterion. The decisions made by a teacher in planning and implementing a small group instructional program are summarized in Appendix C. (A more comprehensive discussion of the planning and decision-making process for small group instructional programs is provided by

Collins, Gast, Ault, & Wolery, in press.)

Mr. Juarez was concerned that the students had never received instruction in a small group instructional arrangement, and that he was going to be teaching a difficult task. Thus, he selected an unpredictable trial sequence. This type of trial sequence ensured that opportunities to respond were randomly alternated among the students throughout the session. Mr. Juarez hoped that the students might be more attentive throughout the session if they didn't know when it would be their turn. Mr. Juarez selected 10 photographs of household items the students regularly used (e.g., knife, bowl, plate). He decided to teach the same two photographs to all students, and to use the remaining eight photographs as distractors. That is, photographs that were presented along with the target photographs during instruction that would ensure that the student was discriminating the target photo from among the other three photos. Because the students were able to sit for periods of no longer than 10 minutes, Mr. Juarez decided that three trials per target photograph for each of the students (a total number of 18 trials per session) would be sufficient to teach the new skill, and could be scheduled daily without difficulty.

Ensuring that the students remained attentive throughout the instructional period was a concern for Mr. Juarez. Thus, in addition to the unpredictable trial sequence, he included several other procedures. First, he decided to use a group attending cue. That is, before the presentation of each instructional trial, he stated "Everybody look" and required eye contact from each student. Second, he provided supplemental reinforcement on the average of every third instructional trial to those students who attended to the students whose turn it was. That is, immediately after Mr. Juarez provided consequences for responding to the photographs, he would praise each student who was attending (e.g., "Maria, I like it when you watch Jessica and Carrie working."). It is important to note that procedures to ensure attention are not always necessary. They are, however, useful adaptations to ensure the attention of students with more severe handicaps or students who have had little previous experience in small group instructional arrangements.

As with any systematic instructional program, clear consequences for student performance should be specified. These include reinforcement for correct performance and some type of corrective when errors occur. Mr. Juarez knew from previous experience that providing stickers to his students was an effective reinforcer. Thus, he provided descriptive verbal praise and a sticker to the students for each correct response during the instructional sessions. Although the constant time delay procedure is described as near-errorless, students may make mistakes on about 5% of the trials. Mr. Juarez decided he would respond to errors in the following manner. If a student made an error during the first two sessions at four second delay, he would tell the student to "wait if you don't know the answer," and then provide error correction. During error correction Mr.

Juarez would model the correct answer and the student would imitate his model. The student would receive a brief statement indicating correctness (e.g., "Right."). Errors in subsequent sessions would be managed by using the error correction procedure alone.

Mr. Juarez's next decisions concerned the selection of a controlling prompt, the number of zero second sessions, and the selection of a delay interval. To identify a controlling prompt, Mr. Juarez conducted brief individual screening sessions. During these sessions, he presented objects and told the student to "Do what I do." For example, he asked the student to "Point to the scissors," and modeled the pointing response for the students. All students consistently imitated the pointing response. Therefore, he selected a model as a controlling prompt because all of the students successfully imitated him. Because the students were preschool-age and had never been exposed to constant time delay procedures, Mr. Juarez elected to conduct two zero-second delay sessions. He decided to use four-second delay trials in all subsequent sessions because the students could respond correctly to other known tasks within four seconds. A final issue that needed to be addressed was to establish a reasonable criterion. Mr. Juarez decided to adopt a conservative criterion in order to ensure the students had learned the behaviors. Thus, he decided to provide instruction until all students in the group had attained 100% unprompted correct responding for two consecutive sessions when reinforced each time they made a correct response (continuous reinforcement), followed by one session in which all students performed at 100% unprompted correct responding when reinforced approximately every third time they made a correct response (intermittent reinforcement).

Constant time delay instructional trials. Instruction began with the zero-second delay trials on two photographs. At the beginning of each zero second trial, Mr. Juarez stated, "Everybody look." When all students were looking at him, he presented a target photograph among the three distractors to one of the students. He then asked the student to point to the target photo ("Maria, point to the fork."). Immediately following the task direction, Mr. Juarez pointed to the photograph of the fork. The student then imitated Mr. Juarez and pointed to the correct photograph, at which time she was reinforced with descriptive verbal praise and a sticker. The use of zero-second delay trials was repeated for all of the students on all trials in the first two sessions.

Because all of the students made 100% prompted correct responses in the first two sessions, Mr. Juarez began his next session (the third session) by inserting a four-second delay interval between the task direction and the delivery of the controlling prompt. These sessions were very similar to the zero-second delay trials, except that after providing the general attention cue ("Everybody look") and the task direction ("Maria, point to the fork"), Mr. Juarez counted, "One-one thousand, two-one thousand, three-one thousand, four-one thousand" to himself before he modeled the correct answer. Mr. Juarez provided consequences to the members of the group based on their responses, as he had done during the zero-second delay trials. After each instructional trial, Mr. Juarez recorded the student's response on a data sheet designed for the receptive task he was teaching. An example of a data sheet for teaching a receptive task in provided in Appendix A. This was followed by presenting an instructional trial to another student in the group. The session continued until each student had received six instructional trials (i.e., three trials on each of the two photographs). Mr. Juarez continued to provide four-second delay trials each session until all of the students met the criteria he established at the outset of the instructional program. An example of a graph which can be used for visually displaying data that is collected during an instructional session is provided in Appendix B.

Teaching an Expressive Task to a Group of Students using a Constant Time Delay Procedure

Select the students and identify the target skill. Ms. Smith had two male and two female students (Jon, Michael, Sabrina, Cheryl) aged 10 years-1 month to 11 year-2 months, with moderate to severe mental retardation, who were participating in community based instruction. However, there were a number of sight words that the students frequently encountered in community settings that they were consistently unable to recognize despite repeated exposures. Before deciding which of the sight words to teach her students, Ms. Smith conducted a prescreening session. The prescreening session confirmed her suspicion that of the approximately 20 community-referenced sight words the students frequently encountered, her students could recognize approximately two of the words. Thus, Ms. Smith decided to teach five different unknown words to each student in a small group instructional arrangement.

Planning the small group instructional program. After she had determined the words that each student would be taught, Ms. Smith decided to use an unpredictable trial sequence. In addition, the target words for each student were alternated daily to ensure that the order of the words would be different. She used the unpredictable trial sequence for two reasons. One, like Mr. Juarez, Ms. Smith wanted to ensure her students were attentive to each instructional trial. Two, she thought that if the students attended to the instructional trials given to their peers, then they might learn additional words through observational learning.

To facilitate student attention and observational learning, Ms. Smith used a group attending cue (e.g., "Everybody look"), and she instituted a dependent group attention contingency. This contingency specified that each student would have five trials (also presented in an unpredictable sequence) on which Ms. Smith would note whether the student was attending when she gave the group attending cue (i.e., "Everybody look"). If the student was attending on his respective instructional trial, then he could earn additional reinforcers for the entire group.

Ms. Smith decided to provide three trials on each of the five words she was teaching to the four members of the group. This meant she would be presenting a total of 60 trials per session. Given the number of trials in each session, Ms. Smith took some extra time to prepare her instructional materials. She made separate index cards for all of the target words (a total of 60 cards). Having each word on an index card saved time during instruction because the cards only had to be shuffled once each session. She saved extra time during instructional sessions by listing each student's name and target word in the random order they would be presented during instruction on the data sheet. She recorded each student's response on the expressive task data sheet after each instructional trial throughout the session. A data sheet for an expressive task is provided in Appendix A.

Ms. Smith also decided to use token reinforcement and descriptive verbal praise during instruction. After each trial on which the student responded correctly, Ms. Smith stated, "Good, that is the word Pepsi," and gave the student a penny. Pennies could be used to purchase items Ms. Smith knew each student found reinforcing, including free time. When a student made an error, Ms. Smith told the student he was incorrect, and to wait for her to provide the answer if he didn't know the answer.

Ms. Smith's students could verbally imitate all of the target words consistently. Thus, a verbal model of the target word was used as the controlling prompt throughout training. Ms. Smith provided one 60-trial session at zero second delay and all subsequent sessions consisted of four-second delay trials. Finally, she employed a criterion that specified individual and group performance. This type of criterion specified that each student had to achieve an individual criterion of one session at 100% unprompted correct responses when reinforced each time he made a correct response. When all students had achieved the individual criterion, the group criterion specified that all students in the group had to perform at 100% unprompted correct responses when reinforced on the average of every third correct response. He adopted this type of criterion to ensure the students had learned the words before conducting generalization training in the community.

Constant time delay instructional trials. Instruction began with one session at zero second delay. During this session, Ms. Smith provided the general attention cue ("Everybody look"), presented the word card to an individual student, asked "What word is this?", and then immediately stated the correct response. After the student imitated the correct response, Ms. Smith provided descriptive praise and a penny. She repeated this for the 60 trials that comprised the first session.

Beginning with the second session and for all subsequent instructional sessions, Ms. Smith used four second constant time delay trials, which were conducted in the following manner. Ms. Smith provided the attention cue, presented the word card to a student, and asked, "What word is this?" She then counted four seconds (e.g., "One-one thousand, two-one thousand," etc.) to herself. If a student responded within the four second interval, he was reinforced with descriptive praise and a penny. If the student did not respond within four seconds, Ms. Smith modeled the correct response, and the student imitated her model within five seconds. The student was reinforced with descriptive praise and a penny. When a student responded incorrectly, he was told that the response was incorrect and asked "to wait if you don't know the answer." This was followed by presenting an instructional trial to another student in the group. The session continued until each student had received 15 instructional trials (i.e., three trials on each of the student's five target words). Ms. Smith continued presenting four-second delay trials until all students had achieved both the individual and group criteria. An example of a graph which can be used for visually displaying data that is collected during an instructional session is provided in Appendix B.

<u>Teaching a Chained Task to a Group of Students using a Constant Time Delay Procedure</u>

<u>Select the students and identify the target skill</u>. Mr. Jones had three students (Billy, Ralph, and Freddy) aged 16-18, with severe mental retardation who were employed at a local business. Because the students worked during the lunch hour, his students needed to bring their lunch to the job site. This provided an opportunity to teach his students to make a sandwich.

Mr. Jones wanted his students to learn to use a variety of sandwich materials, thus he decided to teach the students to make three different sandwiches. After he decided what sandwiches to teach his students to make, he developed task analyses for each sandwich. The task of making sandwiches was a difficult one for his students, therefore, each step in the task analyses consisted of a small amount of information to ensure that the students could learn in a reasonable amount of time.

Planning the small group instructional program. Because Mr. Jones wanted the students to perform the behaviors of each task analysis in sequence, he elected to use a predictable trial presentation; that is, one in which trials were always presented in the same order. To ensure that the students remained attentive throughout the teaching sessions, Mr. Jones required that the students make a choral response on each step of the task analysis. In choral responding the teacher presents the task request to all students in the group and all students respond in unison. Finally, due to the difficulty of the task, Mr. Jones decided to teach the task as a backward chain. He did so for the following reasons. First, when the task analyses for the three sandwiches were completed, he found that in order to make each step sufficiently discrete, he would need to teach approximately twenty to twenty-five steps for each sandwich. He decided that teaching this much new information in each session probably would be too difficult for his students resulting in a high percentage of errors. Thus, teaching one step at a time would be easier for his students to learn and therefore was a more reasonable approach. Second, because he was teaching this skill in a group instructional arrangement, it would be easier to collect data on one training step as opposed to 20-25 steps. Third, Mr. Jones decided to capitalize on the use of backward chaining by having the students practice each step leading to the target step during each instructional trial, in the hope that this practice would facilitate acquisition of future steps. The students performed one complete task analysis each day. When the target step was acquired by each student in the group, they began training on the next (i.e., second to last) step. This continued until they had learned all steps in the task analysis. Mr. Jones then began instruction on the next type of sandwich.

Before selecting a model as a controlling prompt, Mr. Jones conducted several screening sessions in which he asked the students to perform individual steps of non-targeted food preparation skills. During these sessions, he assessed the students' abilities to imitate his behavior. The results of these screening sessions revealed that two of the three students could correctly imitate Mr. Jones' behavior. However, the third student imitated Mr. Jones inconsistently. As a result, Mr. Jones decided that he would use a model as a controlling prompt for two of the students and a physical prompt for the third student. During instructional sessions, instead of modeling the behaviors of the sandwich making skills for the group to imitate, Mr. Jones used the student who required a physical prompt as the model for the other students. That is, he provided a physical prompt to the one student who required it, and the other students were instructed to imitate the behavior of the student receiving the physical prompt.

Consequences for performance included the use of reinforcement for correct responses and error correction for incorrect responses. Correct performance on all training steps was reinforced with descriptive praise (e.g., "Good, you spread the mayonnaise on the bread."). If a student made an error on a training step before the prompt, he was told to "wait if you're not sure what to do," and the correct step was modeled for the student. Following the teacher's model of the step, the student imitated the teacher's model. Errors on non-training steps were ignored and the teacher arranged the student's sandwich materials to facilitate completion of the next step.

Mr. Jones elected to use a group criterion to evaluate the students' performance of the sandwich-making skills. The criterion specified that the students had to perform for two consecutive days at 100% unprompted correct responses when reinforced for each correct step, followed by one day at 100% correct when reinforced on the average of every third correct response and finally respond at 100% unprompted correct responses when reinforced only at the end of the tasks (e.g., after 25 steps).

Constant time delay instructional trials. The zero-second delay instructional trials were conducted in the following sequence. The teacher presented the task direction, the student who required a physical prompt was guided through all of the steps in the chain, and the students imitated that student. Immediately following the completion of the next to the last step, Mr. Jones delivered the controlling prompt for the target step. The students imitated the behavior of the student who received the physical prompt. Following completion of the task analysis the students were reinforced with descriptive praise.

During five-second delay trials, the steps were modeled as described above. However, immediately following the completion of last non-training step, Mr. Jones began counting to himself (i.e., one-one thousand, two-one thousand, etc.) before he provided the controlling prompt. During five-second delay trials, Mr. Jones provided consequences in the following order. First, he provided reinforcement to the students who made an unprompted correct response. These students received descriptive verbal praise. Second, students who made unprompted errors, and those waiting for a prompt, received consequences at the same time. The students who made an incorrect response were told to wait and received a correction trial which served as the controlling prompt for the students waiting for assistance. Ms. Smith recorded data on the students' responses on a data sheet for chained tasks (see Appendix A for an example) after the last student received consequences on each training step. Training proceeded in this sequence until all students had met the group criterion for each sandwich. An example of a graph which can be used for visually displaying data that is collected during an instructional session is provided in Appendix B.

Problems Implementing Small Group Instructional Arrangements

Implementing systematic instruction in small group arrangements occasionally may prove problematic. Some problems are specific to conducting group instruction (Collins et al., in press), and some are specific to the use of constant time delay procedures (Schuster & Griffen, in press; Snell & Gast, 1981; Wolery, Ault, & Doyle, in press). Problems that might be encountered when implementing group instruction may include the selection of students with disruptive behaviors, those who lack prerequisite skills or who attend school infrequently, the identification of a skill which is too difficult for some group members, and the use of ineffective consequences for performance. Solutions for these types of problems can be addressed by carefully assessing prospective group members prior to their inclusion in the group and by employing systematic instructional practices (e.g., Snell, 1987; Wolery, Bailey, & Sugai, 1988). Problems that might be encountered with the use of the constant time delay procedure include a high percentage of unprompted errors (i.e., more than 25% of the total amount of the student's responses for a session), a high percentage of prompted errors, and the failure to make unprompted responses. Unprompted errors can be managed by reminding many students to wait if they do not know the correct response, providing negative consequences for failing to wait, or by shortening the delay interval. For some students wait training may be necessary (Snell & Gast, 1981). High percentages of prompted errors indicate the need to reevaluate the controlling prompt and identify one that ensures correct responses. Students who fail to make an unprompted correct response often need to be taught that it is okay to make a response if they know it. Some students may require a change in the way consequences are delivered. That is, the teacher may want to tell the student that rewards will only be provided to students who respond before the prompt is provided (i.e., differential reinforcement of unprompted and prompted correct responses). This latter contingency should be used only when the teacher is certain that the student has acquired the target behavior, but for some reason resists making an unprompted correct response.

Summary

In summary, teaching students in small group instructional arrangements of three to five students with constant time delay can be a successful approach to providing instruction to students with a variety of handicapping conditions. The examples of instructional programs and the data sheets that are provided in this paper are based on actual instructional programs that have been successfully implemented by teachers. Thus, after some initial adaptation by the classroom teacher, these programs can be implemented successfully by most teachers.

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APPENDIX A

GROUP DATA SHEETS

This is an example of a data sheet for a receptive language task conducted in a small group instructional arrangement. This data sheet uses Before and After columns to record student responding when using constant time delay to teach a receptive task. Prior to the instructional session, the teacher would complete the situational information (e.g. teacher's name, session number). This would be followed by placing a "x" in the attending column when supplemental reinforcement for attending will be given to all students. The delay interval column will tell the amount of time between the task direction and the prompt. The "Sd" column is the target object and "Distractors" indicate the choices that the student can select from. If the student responds correctly before the prompt, record a "+" in the Before column; an incorrect response before the prompt is recorded by placing a "-" in the Before column. If the student responds correctly after the prompt a "+" is placed in the After column; if an error is made after the prompt, the teacher records a "-" in the After column. If the student makes no response after the prompt, the teacher should record "o" in the After column. At the end of the session, each type of response would be counted and the percentage calculated.

Teacher ______________________ Date ____/____/____

Session Number ________________ Session Time ____:____

Tr. #	Attn. Cue	Delay Interval	Student name: CARRIE				Response		Student name: JESSICA				Response		Student name: MARIA				Response	
			Sd	Distractors			Bef	Aft	Sd	Distractors			Bef	Aft	Sd	Distractors			Bef	Aft
1			fork	cup	hat	bowl														
2	X								knife	coat	bowl	plate								
3															fork	cup	coat	plate		
4																				
5	X																			
6																				
etc																				
18																				
Total Number of Each Response Type			Correct Bef			Correct Aft			Correct Bef			Correct Aft			Correct Bef			Correct Aft		
			Errors Bef			Errors Aft			Errors Bef			Errors Aft			Errors Bef			Errors Aft		
						No Respon						No Respon						No Respon		
Total Percent of Each Response Type			Correct Bef			Correct Aft			Correct Bef			Correct Aft			Correct Bef			Correct Aft		
			Errors Bef			Errors Aft			Errors Bef			Errors Aft			Errors Bef			Errors Aft		
						No Respon						No Respon						No Respon		

This data sheet is designed to be used with an expressive task (e.g., sight word reading) conducted in a small group instructional arrangement. This data sheet uses columns for each type of response that can occur during the instructional session. The teacher begins by recording the situational data (e.g. name, date, etc.). In addition, the teacher records the stimulus and the student who will receive the trial in the order they will be presented. The teacher then places a "x" in the attending column indicating when supplemental reinforcement for correct attending during another student's trial should be provided. Also, the teacher records the delay interval to be used on each trial. When a student responds during instruction the teacher places a check in the appropriate column. After the session, the number of checks from each column are summed and divided by the number of trials to determine the percentage of each type of response for each student.

Teacher ____________ Date ____________ Procedure ____________

Start Time _____:_____ Stop Time _____:_____ Total Time _____:_____

Task: ____

TRIAL	STUDENT	STIMULUS	Attn. Cue	Delay	TYPE OF RESPONSE				
					Unpro Corr.	Prom. Corr.	Unpro. Error	Prom. Error	No Resp.
1	John	EXIT							
2	Michael	PEPSI							
3	Sabrina	ENTER	X						
4	Cheryl	TELEPHONE							
5	Michael	EMERGENCY							
6	Sabrina	HOSPITAL							
7	Cheryl	PUSH	X						
8	John	FIRE							
9	Sabrina	PULL							
10	Cheryl	TELEPHONE							
etc.									
60	Michael	EMERGENCY	X						
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								
Student:	Total Number of Each Response Type								
	Percent of Each Response Type								

This is a sample data sheet for chained tasks taught with the constant time delay procedure in a small group instructional arrangement. Although the narrative describes teaching sandwich making using backward chaining, this data sheet can also be used with forward or total task presentation. The teacher initially completes the situational data at the top of the form followed by recording the steps in the task analysis. The teacher then records the delay interval to be used for the steps in the task analysis. For example, in the first instructional session when using backward chaining,the teacher simply models steps 1-24, records "o" in the delay column for step #25 and provides the controlling prompt for that step. This would be followed by recording the student response on step #25 ONLY. If the student responds correctly before a prompt a "+" is placed in the Before column. If the student responds correctly after the prompt, a "+" is placed in the After column. Incorrect responses before the prompt are recorded with a "-" in the Before column; incorrect responses after the prompt with a "-" in After column; and no response after the prompt is recorded by placing a "o" in the After column. At the end of each session, the teacher sums the total number of each response type and calculates the percentage for each student in the group.

Teacher______________________ Date__________________

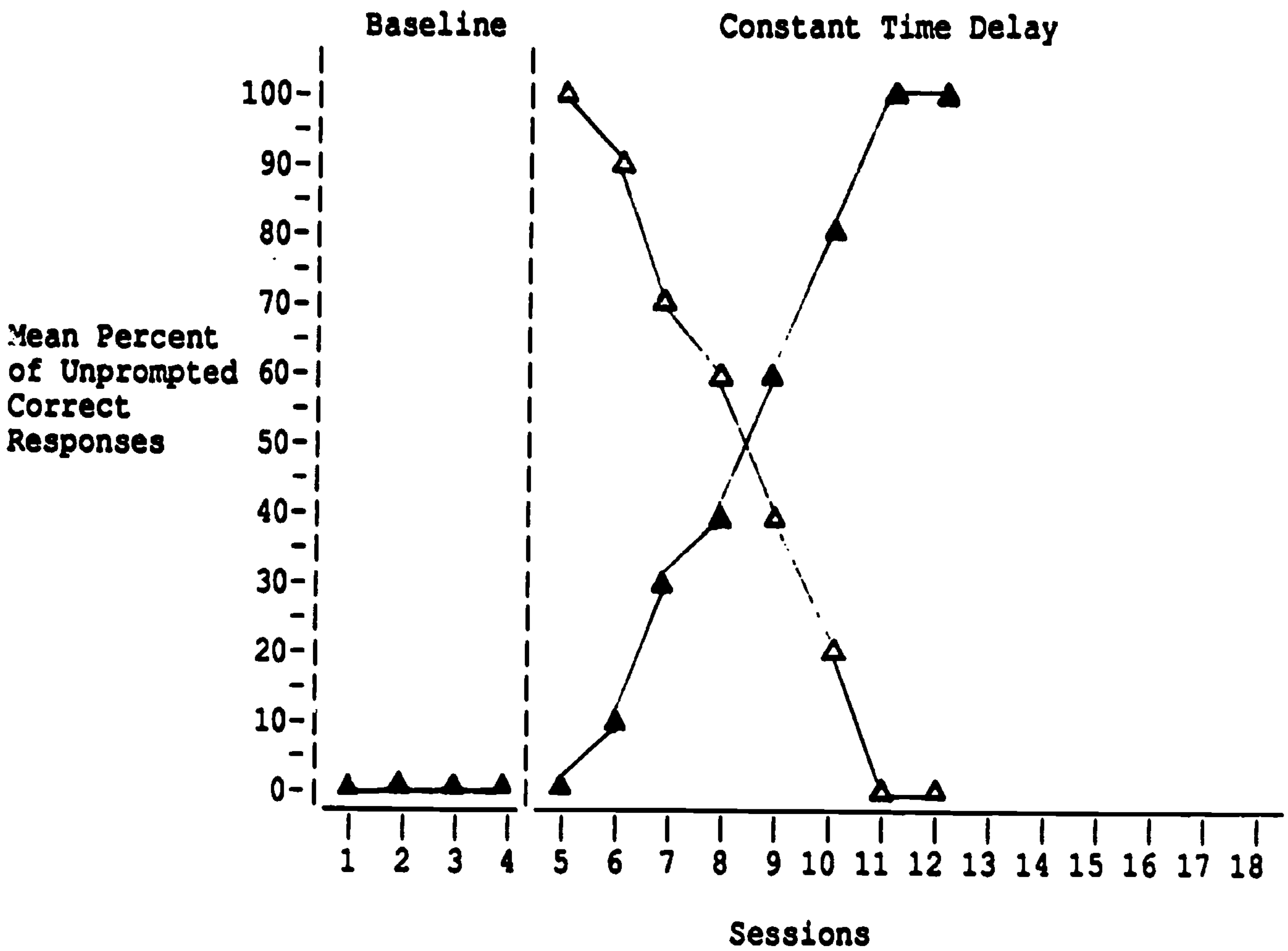
Session______________________ Time__________________

Steps in Task Analysis	Delay Interv.	Student Name: BILLY		Student Name: RALPH		Student Name: FREDDY	
		Before	After	Before	After	Before	After
1. Bread from cabinet							
2. Get meat, cheese, mayo							
3. Knife from drawer							
4. Open bread bag							
5. Remove 2 pieces							
6. Lay flat on counter							
7. Close bread bag							
8. Return to cabinet							
9. Open mayonnaise							
10. Dip knife in mayo							
etc.							
25. Knife in sink							
Summary Data	Corrects	#= %	#= %	#= %	#= %	#= %	#= %
	Incorrects	#= %	#= %	#= %	#= %	#= %	#= %
	No Resp.		#= %		#= %		#= %

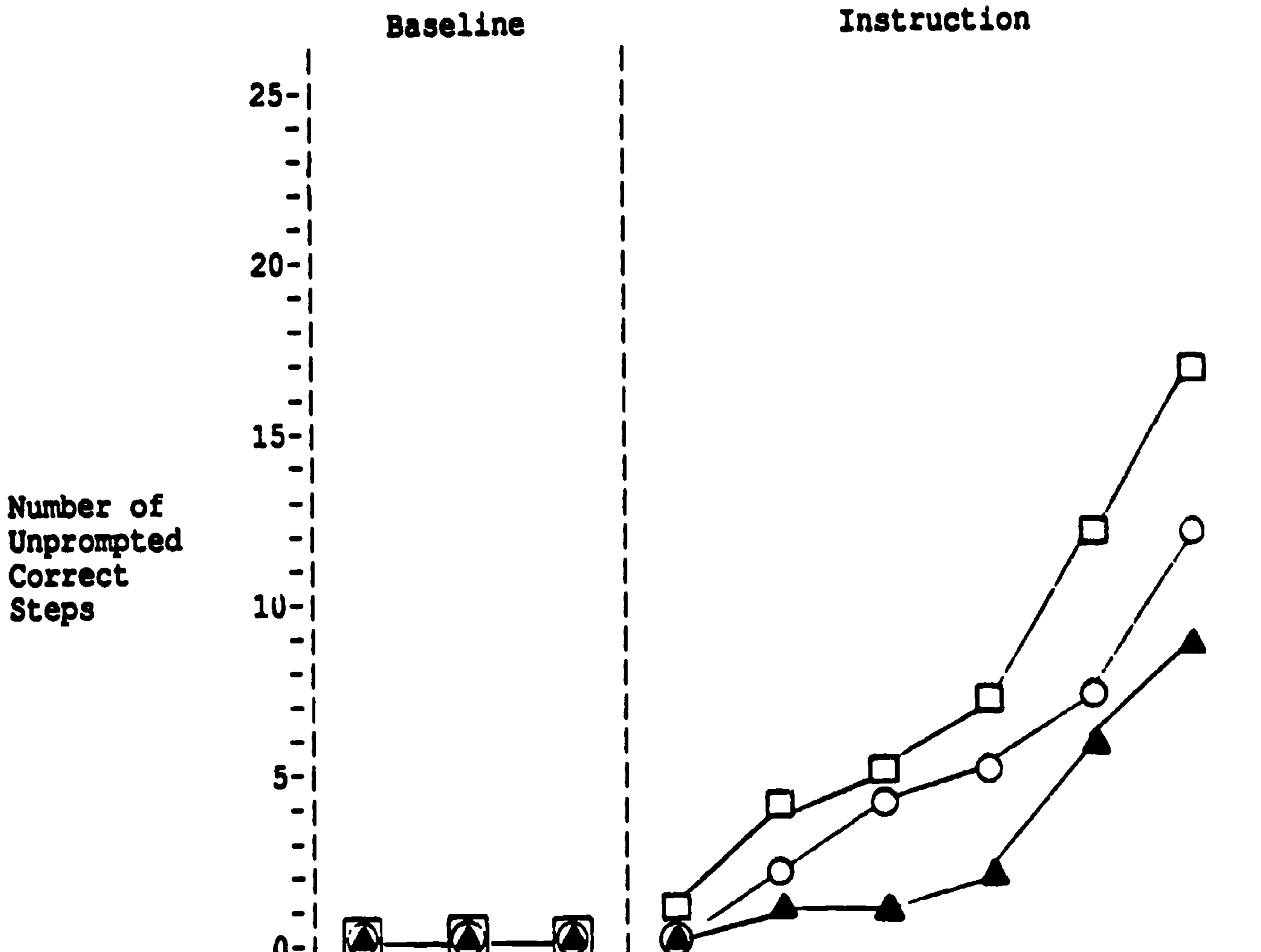
APPENDIX B

VISUAL PRESENTATION OF DATA

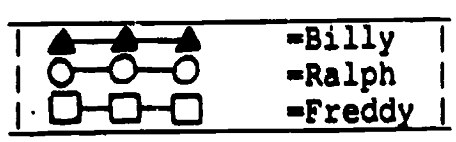
This line graph displays the mean performance of a group of students involved in a time delay instructional program. The closed triangles represent the group's mean percentage of correct unprompted responses during the daily session. The open triangles represent the mean percentage of correct prompted responses. This graph can be used with both the receptive and expressive constant time delay programs.



This graph is a visual display of data from the sandwich making task for Billy (B), Ralph (R), and Freddy (F). Each student's data is represented by a different symbol. Following the small group instructional session with constant time delay, the teacher transfers the sum of correct responses **BEFORE** the prompt found on the data sheet for each student. This number is placed in the total corrects column on this figure then plotted with the appropriate symbol. Although this graph allows the teacher to monitor individual as well as compare student performance, it probably should not be used with more than 3-4 students since this number of symbols on one graph could be confusing.



Session/Trial	1			2			3			4			5			6			7			8			9		
Student	B	R	F	B	R	F	B	R	F	B	R	F	B	R	F	B	R	F	B	R	F	B	R	F	B	R	F
Total Corrects	0	0	0	0	0	0	0	0	0	0	0	2	1	2	4	1	4	5	2	5	7	6	7	12	9	12	17
Date	2/16			2/17			2/20			2/21			2/22			2/23			2/24			2/25			2/28		



APPENDIX C

TEACHER DECISIONS FOR SMALL GROUP INSTRUCTIONAL PROGRAMS

Teacher Decisions for Small Group Instructional Programs

Component of Group Instruction	Teacher Decision
Select students	Identify homogeneous or heterogenous students.
Prerequisite skills	Identify students with good attendance, minimal disruptive behaviors, previous experience with systematic instruction and delay, reliable wait response, attending behaviors, work for 10-20 minute sessions.
Instructional trial sequence	Predictable or unpredictable.
Student responses	Individual or choral.
Identify task, select stimuli	Same task, same stimuli; different task, different stimuli; functional, chronologically age-appropriate.
Attention (individual)	General or specific attention responses.
Attention (group)	Independent, dependent, or interdependent.
Consequences for performance	Correct, incorrect, no-response.
Procedure	Constant time delay.
Controlling prompt	Verbal, model, gesture, physical.
Time delay interval	Specify time delay interval.
Number of zero-second sessions	Specify number of zero-second sessions.
Criterion	Individual, group, or both.