Improving the System of Least Prompts: A Comparison of Procedural Variations

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Abstract: Given the frequency with which the “system of least prompts” is used, it is important to identify procedures to enhance the effectiveness and efficiency of the system. This study compared effects of a traditional least to most procedure (TLM) and a revised least to most procedure (RLM) on skill acquisition in individuals with moderate and severe disabilities. One prompt sequence (TLM) contained verbal prompts paired across the hierarchy and another sequence was devoid of verbal prompts (RLM). Four students were instructed with each prompt sequence within a parallel treatments design. Results indicated that, although both prompt sequences were effective, efficiency data (time and effort to transfer stimulus control) favored the RLM procedure.

To assist individuals with significant disabilities, teachers often provide response prompts in the form of verbal directions, gestures, demonstrations, or physical assistance during instruction. Such prompts are supplementary stimuli that increase the probability that desired behaviors will be emitted by students, and be reinforced, in the presence of natural cues for those behaviors (Baine, 1981; Billingsley, 2003). In other words, teachers use prompts in order to help their students become successful. Because response prompts are “supplementary,” however, educators fade them so the student responds appropriately when only the natural cue is present.

The terms “cue” and “prompt” are used interchangeable in the literature. However, the two terms can be used to refer to different categories of stimuli and it is important to distinguish cues from supplementary prompts as described above to create a definitional framework. Learning is a process of understanding how to respond to specific and changing cues across environments. To foster independence, students with disabilities must be able to respond in the presence of natural cues rather than rely on prompts. Natural cues are “persons, objects, or events that should act as ‘signals’ for learned behavior to occur outside of instructional situations; natural discriminative stimuli” (Billingsley, 1998, p. 157). Educators also use verbal stimuli as natural cues to evoke behavior. A verbal cue should act as a signal for learned behavior to occur outside of the instructional situation. For example, when going to a restaurant, a student must learn how to respond to the natural verbal cue from the waiter such as, “What would you like to eat?”

The system of least prompts (“least to most” or “increasing assistance” prompting) is one fading method designed to achieve appropriate student responding when only the natural cue is present. This system contains presentation of a presumed prompt hierarchy that is ordered from least to most intrusive. For example, a student is given the opportunity to respond to a natural cue (perhaps a request or direction from a teacher). If the student responds incorrectly, or fails to begin to respond within an established amount of time (often 5 seconds; Doyle, Wolery, Ault, & Gast, 1988), prompts are provided in a format from least to most intrusive until a correct response occurs. That is, if the student failed to respond to the teacher’s request correctly within the allotted time period, the teacher might provide a directive verbal cue. If the directive verbal cue alone was insufficient to evoke the correct response, the teacher might pair it with a gesture or a demonstration of the desired behav-
ior. Finally, in the absence of a correct response, the teacher might once again provide the directive verbal cue while assisting the student through hand over hand (or hand under hand) physical assistance. Although applications of the procedure vary in terms of number and types of prompts provided, many are consistent in: (a) moving through a series of predetermined prompts contingent upon errors or failures to respond; (b) use of a target stimulus plus three levels of prompts, often representing verbal, visual, and physical modalities; (c) providing reinforcement at the point in the prompt sequence at which the student emits the desired response and (d) pairing a verbal cue with other prompts (Doyle et al.). Descriptions of the system of least prompts contained in many recent “methods” texts reflect such characteristics (Halle, Chadsey, Lee, & Renzaglia, 2004; Hilton & Ringlaben, 1998; Westling & Fox, 2004).

As Wolery, Ault, Doyle, and Gast (1986), Doyle et al. (1988), and Westling and Fox (2004) indicate, the system of least prompts is a popular instructional strategy that is used to teach both discrete responses and chained tasks. In their review of twelve different instructional strategies used in 275 applied research articles, Wolery et al. observed that the system was used more frequently than any other method. Further, Doyle et al. documented use of the system across a variety of skill domains including community and daily living, social/leisure, vocational, self-care, motor, and language/cognitive domains.

At least in part, the popularity of the system of least prompts may be accounted for by its ease of application: it does not require an assessment to determine the controlling prompt as in the case of time delay, or most to least procedures, or simultaneous prompting procedures, it does not require a frequent review of student performance data following instructional sessions in order to make instructional decisions, it does not require “test” or “probe” sessions outside the instructional context, and, typically, it is administered according to an invariant script. Given the “self fading” qualities of increasing assistance procedures, such procedures would seem particularly useful where numerous individuals (e.g., typically developing peers, paraeducators, classroom volunteers, support professionals) who have not had extensive preparation in systematic instructional procedures may provide educational experiences for students with significant disabilities.

Although easy to employ, widely used, and frequently recommended, the system of least prompts often suffers in comparison to other prompt fading procedures in terms of efficiency (Ault, Wolery, Doyle, & Gast, 1989). Use of the system may result in slower transfer of control of the target behavior to natural cues. While it is possible to speculate regarding the role of several characteristics of the procedure in delaying transfer of stimulus control, one of several possible factors that could lead to inefficient transfer may be the extensive use of verbal prompts often used in the system. Verbal prompts can be thought of as auxiliary discriminative stimuli that teachers provide to increase the probability that a desired behavior will occur and be reinforced in the presence of the natural cue. For example, a student may be given the opportunity to respond to a natural cue (perhaps a request or direction from a teacher to transition to recess). If the student responds incorrectly, or fails to begin to respond within an established amount of time, the teacher might provide a directive verbal prompt or other prompt to evoke a response. Many individuals with significant disabilities, particularly those with autism, may experience difficulty in understanding and responding appropriately to verbal information (Dettmer, Simpson, Myles, & Ganz, 2000; Grandin, 1995; Schopler, Mesibov, & Hearsey, 1995; Schuler, 1995; Walls, Ellis, Zane, & Vanderpoel, 1979). If this is, in fact, the case, then use of a noncontrolling verbal prompt as the first in the series of prompts may not acquire control over the target behavior, or may do so very slowly, and may result in relatively high rates of errors for some students. As Doyle et al. (1988) stated, learning may be hindered where “nonfunctional stimuli are inserted between the initiation of the trial and the controlling response” (p. 37; see also Billingsley, 1998). On the other hand, for other students, pairing the verbal prompt with other prompt levels which (eventually) produce the target behavior and reinforcing consequences may make it particularly likely that the initial verbal prompt will
acquire control over the behavior, thereby adding a potential step to the fading process. Therefore, it seems that in either case (that is, where the initial verbal prompt does not come to effectively control the response as well as when it does gain control), transfer of stimulus control may be delayed.

A primary goal of instruction is to teach students to respond appropriately to task stimuli. Instructional strategies aid in achieving this goal by ensuring effective and efficient transfer of stimulus control from teacher-delivered prompts to intended discriminative stimuli. An instructional strategy can be considered “effective” when students acquire skills being taught with the procedure; it can be called “efficient” when it minimizes time and effort to learn the skills (Wolery, Ault, & Doyle, 1992). Students with substantial cognitive disabilities and autism demand the most effective and efficient instructional strategies. It is important that educators use the most parsimonious procedures to increase teaching efficiency when establishing or transferring stimulus control (Etzel & LeBlanc, 1979). Teachers should also choose procedures that allow for ease of implementation while producing positive changes in behavior.

Given the popularity of the system of least prompts, it is surprising that studies designed to examine procedural variations that might increase its efficiency are virtually nonexistent. An exception is a study by Steege, Wacker, and McMahon (1987) who found that a “prescriptive procedure,” in which the beginning prompt in the sequence was varied across instructional trials contingent upon prior student performance, resulted in improved instructional efficiency as compared to the traditional procedure. The gain in efficiency, however, was also accompanied by an increase in procedural complexity.

The purpose of the present study was to ascertain whether simply removing verbal prompts from the sequence for students for whom those verbal prompts did not initially evoke the target behavior would produce more efficient skill acquisition with fewer errors than a more traditional sequence containing such prompts.

Method

Participants

Participants were enrolled in a university based, fully inclusive early childhood program. Each student was from a middle class socioeconomic background where English was the primary language. Informed consent from each child’s parent or guardian was obtained prior to the study.

Two phases were implemented during this study and two students participated in each of the two phases. Olivia and Elijah participated in Phase 1 and Alex and Owen in Phase 2. Following is a description of the participants including age, diagnosis, and developmental profile.

Olivia. Olivia was a 6 year 2 month old with a diagnosis of autism who attended an integrated full-day kindergarten classroom. She could match items by picture, color, and/or shape, but required adult assistance to complete most activities. Olivia could use a spoon and fork appropriately and drink from a cup with little to no spilling and responded to familiar adults by running up to them and smiling. She played near peers and required teacher assistance to interact with them. Olivia was primarily nonverbal, however, has produced single words, short phrases, and was able to imitate sentences.

Elijah. Elijah was a 6 year 2 month old with a diagnosis of autism who attended an integrated full-day kindergarten classroom. He could follow simple routines with minimal teacher assistance, but needed assistance to remain in close proximity with his peers during group time. Elijah could write his name and independently complete several academic tasks (e.g., puzzles, matching games, and tracing worksheets). He did not initiate interactions with peers, nor did he respond to peer interactions, and he engaged in solitary play. Elijah would seek out familiar adults by going to them and pulling their hand and giggling. He had a limited diet of preferred foods and would eat with a spoon and drink from a cup. He was primarily nonverbal, but has demonstrated the ability to imitate simple signs and words. Elijah was able to follow one-step simple directions, but this skill was not consistent across activities. The Picture Exchange Com-
munication System (Bondy & Frost, 1994) was used by Elijah to request food at snack time.

Alex. Alex was a 5 year 10 month old with a diagnosis of autism who attended an integrated full-day kindergarten classroom. He had learned 15 letter/sound correspondences through 10 and could count to at least 30. He was interested in books and was building his sight word vocabulary. Minimal adult support was provided for Alex to assist him in remaining near peers during large group instructional times. Alex demonstrated good daily living skills, being able to dress himself and clean up after himself. He would engage in parallel or solitary play with peers. Alex was primarily nonverbal and demonstrated limited comprehension of language. His understanding of communicative partners was dependent on contextual support. He used the Picture Exchange Communication System to request food items during snack. To communicate his needs, Alex would also physically move others to the object or activity of desire. He used echolalia and had been observed to spontaneously utter a previously memorized word. Alex demonstrated difficulty with imitation skills and exhibited decreased attention making it difficult for him to participate in age appropriate fine and gross motor activities.

Owen. Owen was a 6 year old with a diagnosis of autism who attended an integrated half-day afternoon preschool classroom. He could identify six colors, count past 20, and could identify numerals 1-20. Owen could remain with a group during large and small group activities and would play in close proximity to peers, but preferred to engage in solitary play. Classroom personnel worked with Owen on imitating adult and peer actions and to complete self-help routines. Owen demonstrated difficulty following novel verbal directions when visual cues were not provided. He independently spoke in one-two word phrases, would name objects in the classroom environment, and could imitate words and short phrases. Owen did not initiate verbal greetings or gain attention from an adult or peer using language. Good eye contact was exhibited by Owen when demonstrating persistence or to gain attention. He was on a sugar and gluten free diet, which limited the repertoire of foods that could be provided to him. Owen was motivated by physical activity and loved to climb and swing.

Setting
The study was conducted at the children's early childhood program. All experimental conditions of the study occurred in their inclusive classroom at natural times embedded within the classroom routine. Children from birth to age 7 years with diverse abilities were referred to the program by parents, professionals, school districts and community agencies. The school program, which was a state-certified program of specialized education, included services provided by an interdisciplinary team comprised of a classroom teacher, speech and language pathologist, occupational or physical therapist and other professionals. Each classroom included children with disabilities as well as typically developing youngsters.

Olivia and Elijah attended the same integrated kindergarten classroom. The other kindergarten student, Alex, participated in another full-day integrated classroom with a similar format. The kindergarten classroom consisted of 18 students, 10 of whom were on individualized educational plans (IEP’s) with the remaining 8 considered to be typically developing. Three adults were present to support the students, specifically the head teacher, assistant teacher, and classroom aid. Twice a week more assistance was provided by a speech and language pathologist and once a week an occupational therapist and physical therapist provided assistance.

Owen attended an integrated preschool classroom that served 16 students, 10 with IEPs and six considered to be typically developing. Two adults, the head teacher and assistant teacher, supported the classroom. In addition, the speech and language pathologist assisted three times per week and the physical therapist assisted twice per week.

Tasks
To make comparisons between procedures using the experimental design employed in this investigation, it was necessary to identify tasks
that were of equal difficulty. Tasks were considered equal if: (a) similar types of stimuli were used and required the same response mode (topography, e.g., naming), (b) students could perform the response with the same level of prompt during trials prior to instruction, and (c) students produced comparable baseline data on both tasks (Gast & Wolery, 1988). Tasks were chosen after each child’s individualized educational plan was reviewed and goal areas identified. Behaviors selected reflect academic and functional domain areas.

Tasks chosen for comparison during Phase 1 with Elijah and Olivia included pouring a beverage and spraying plants, and receptive identification of two groups of three words selected by the teacher from classroom curriculum materials (ball, dog, and bell; and cat, bus and hat). Correct independent performance for beverage pouring required that the student pick up a small pitcher and pour an amount into a cup within 5 s of being presented with the task materials at the snack table. Correct performance for spraying required that the student pick up the plant sprayer, aim towards the plant, and press the handle to engage the spray within 5 s of being presented with the task materials placed in front of the plant. In the receptive word identification tasks, correct independent performance was defined as the student pointing to the correct word within 5 s of the instruction “point to.”

The set of tasks chosen for comparison during Phase 2 with Alex and Owen included pouring a beverage and spraying plants, and retrieving own backpack or coat and retrieving identified item to take to playcourt. Owen did not use a backpack for school, thus retrieving his coat was used as the comparison. Identification of correct independent performance for pouring a beverage and spraying plants was identical to Phase 1. Correct independent performance for retrieving own backpack or coat was defined as the student obtaining his/her backpack or coat from a cubby area within 10 s of the large group verbal instruction that it was “time for playcourt.”

Fading Procedures

Two fading procedures were used to transfer stimulus control to the natural cue, one that used verbal prompts and another that was void of verbal prompts.

TLM. The traditional least to most procedure involved a prompt hierarchy that was ordered from least to most intrusive. The student was given the opportunity to perform a task independently following the natural cue (i.e., spray bottle filled in front of plant at scheduled time to perform task) and, when an error response or no response occurred within 5 s, the prompt sequence was initiated, beginning with the use of a directive verbal prompt (i.e., “spray the plant”). If an incorrect or no response occurred within 5 s, a gestural prompt was provided. Finally, in the case of an incorrect or no response within 5 s of the gestural prompt, the instructor provided the student with full physical assistance in the form of hand-over-hand guidance to complete the task. The process continued throughout instruction until the student responded correctly and independently. As suggested by Wolery, Ault, Gast, Doyle, and Griffen (1990) the directive verbal prompts also accompanied the gestural and physical prompts in the traditional system.

RLM. In the revised least to most procedure, the same instructional format as the traditional system was used; however, the directive verbal prompt was omitted as both the initial prompt in the sequence and as an accompaniment to gestural and physical prompts. Therefore, following presentation of the natural cue, the first prompt given was gestural. In between each prompt, the student received a time delay no greater than 5 s, as was the case in the TLM procedure.

Design and Data Collection

A parallel treatments design was used. This design is a combination of two concurrently implemented multiple probe designs across behaviors (Gast & Wolery, 1988). Counterbalancing tasks and treatments across individuals provides control for effects of extraneous vari-
ables. The parallel treatments design introduces two interventions into two or more separate and individually assigned sets of tasks and, as noted by Gast and Wolery, is well suited for investigations comparing effects of two or more instructional strategies.

During both phases of the study, baseline data were collected in which task performance was recorded in the absence of prompts for a minimum of three days. Once a stable baseline was evident, as demonstrated by performance, instruction was implemented. Two instructional sessions, one using the TLM procedure and one using the RLM procedure occurred each day, Monday through Friday.

Throughout the investigation, correct responses were recorded where the student independently initiated and completed the task without receiving any prompts from the instructor. Each prompt required by the student was scored as an error.

During implementation of Phase 1, Olivia and Elijah received one session in the morning and the other in the afternoon with a minimum of four hours between sessions. Use of each procedure, TLM and RLM, was counterbalanced across morning and afternoon sessions. Instructional sessions lasted no longer than 10 minutes and were conducted in a 1:1 instructional arrangement. Each child was first presented with the first pair of tasks (Set 1), pouring juice and spraying plants. For Olivia, pouring juice was taught using the TLM method, while spraying plants was taught with the RLM. For Elijah, pouring juice was taught using RLM and TLM for spraying plants. Criterion for each task was 100% correct independent responding for one session. Once criterion was reached for Set 1, Set 2 tasks were taught. Each student was provided five instructional opportunities with each skill per session during Set 1 and one opportunity to retrieve an item and backpack or coat for Set 2.

During Phase 2, a similar format was used for Alex and Owen. A minimum of 2.5 hours occurred between instructional sessions and, once again, the tasks were counterbalanced across these sessions. Instructional sessions lasted no longer than 10 minutes and were conducted in a 1:1 instructional arrangement. Set 1 instruction consisted of teaching each child the first pair of tasks. Pouring a beverage was taught to Alex using RLM and spraying plants was taught using TLM. For Owen, pouring a beverage was taught using TLM and RLM for plant spraying. Set 2 instruction consisted of teaching Alex to retrieve an item using RLM and retrieving his backpack using TLM. Owen was taught to retrieve an item using TLM and to retrieve his coat using RLM. Criterion for each task was 100% correct independent responding for one session. Once criterion was reached for Set 1, Set 2 tasks were taught. Each student was provided five instructional opportunities with each skill per session during Set 1 and one opportunity to retrieve an item and backpack or coat for Set 2.

Research associates (one for Phase 1 and another for Phase 2) conducted assessments regarding reliability of data collection at least once each week for both instructional procedures. The research associates were both teachers with experience working with children who have mental retardation and autism. Associates were also familiar with the participants in that they worked in the children’s classroom as assistants. Associates were provided with a study protocol for each child prior to the initial reliability session. During the training session the protocol and procedural reliability data sheet were reviewed and questions answered. Data collection training consisted of teachers viewing role-playing scenarios of the principal investigator with a volunteer while recording data to 100% accuracy across all instructional procedures. Reliability sessions began when personnel obtained 100% accuracy from three data collection training trials.

Reliability estimates were calculated using the point-by-point method in which number of agreements was divided by number of agreements plus disagreements and multiplied by 100. Data were based on whether the observer noted responses as independent or
not independent. In the TLM condition, percent agreement across all experimental conditions was 90.3%. Percent for participants in the RLM condition was 95.5%.

Procedural reliability (Billingsley, White, & Munson, 1980) assessments were conducted simultaneously with data collection reliability checks (at least once each week). Data were collected on the teacher’s compliance with planned procedures. Teacher behaviors assessed during instructional sessions included: arranging materials so the student could access items, presenting the task direction, waiting the appropriate response interval, and providing the appropriate prompt.

Procedural reliability estimates were calculated by dividing number of correct teacher behaviors recorded by the observer by number of planned behaviors that should have been emitted in the session, and multiplying by 100. Estimates for procedural reliability included mean percent (and range) of agreement in each condition, on each of the teacher behaviors. Means for each variable for each condition and subject were above 95%.

Procedure

Baseline. During baseline conditions, trials began with the instructor stating the student’s name and presenting the task materials at a designated, natural location. Task materials were similar to those used during instructional sessions. Students were not provided with prompts to complete the tasks and were given approximately one minute before a failure was recorded. If a correct response occurred at any time during the delivery of the task, the instructor recorded the response, and provided verbal praise and an edible reinforcer (small piece of candy). Once a stable baseline was evident, instruction was implemented.

Following baseline conditions, the procedures used to teach each of the tasks were assigned to the students as defined above with the stipulation that all tasks would be taught with both procedures within student pairs.

Instruction. During TLM instructional trial, the instructor placed all needed materials in an identified location and said, “Are you ready to _____?” The student was given the opportunity to perform the task independently in response to the natural cue with the instructor waiting 5 s. If the student did not respond or responded incorrectly, the instructor provided the first prompt level in the hierarchy (directive verbal) and waited 5 s. If the student again did not respond or responded incorrectly, the second prompt (directive verbal and gestural) was provided, and the instructor waited 5 s. If the student still did not respond or responded incorrectly, the final physical prompt (full physical assistance) and directive verbal was delivered. If a correct response occurred at any time during delivery of the prompt hierarchy, the instructor recorded the response, and provided verbal praise and an edible reinforcer (small piece of candy). Verbal praise consisted of the instructor saying, “Good” and describing the task the student performed correctly (e.g., “good spraying the plant”). Only unprompted correct responses counted toward criterion. A similar format was used with RLM with the hierarchy beginning with a gestural prompt.

Results

Data on number of sessions to criterion indicated a reliable and substantial advantage favoring the RLM procedure for Elijah and Owen. For Olivia, either no or scant difference was noted in sessions to criterion. Data for Alex were mixed across task sets, but, consistent with findings for Olivia, differences observed were slight.

Figures 1-4 present number of independent correct responses for each participant during each instructional session. No correct, independent responses were observed for any student during baseline sessions across task and procedures. Raw data were transformed into the sum of all independent responses to generate a per-session score for each participant.

All students achieved criterion performance under both instructional procedures. Phase 1 with Elijah and Olivia consisted of Set 1 with five possible correct responses per session and Set 2 with nine possible correct responses per session. Using TLM, Elijah met criterion at instructional session 14 for Set 1 and session 8 for Set 2. When RLM was used, Elijah met criterion at session 9 for Set 1 and 4 for Set 2. Olivia met criterion at session 12 for Set 1 and session 6 for Set 2 using TLM. Using RLM,
Olivia met criteria at session 12 for Set 1 and session 5 for Set 2.

Phase 2 with Owen and Alex consisted of Set 1 with 5 possible correct responses per session and Set 2 with 1 possible correct response per session. Owen met criterion using TLM at session 4 for Set 1 and session 7 for Set 2. When RLM was used, Owen met criterion at session 3 for Set 1 and session 2 for Set 2. Alex met criterion during Set 1 at session 4 and session 3 during Set 2 when TLM was used. When RLM was implemented, Alex met criterion at session 5 for Set 1 and session 2 for Set 2.

Relative efficiency of the two procedures was assessed by analysis of number of sessions and number of errors for each participant.
These data were calculated from information collected on the first day of instruction through criterion. Efficiency data for Olivia and Elijah are presented in Table 1 and data for Alex and Owen in Table 2. In Phase 1, the revised system required fewer sessions to reach criterion on all tasks for Elijah than the traditional system (13 using RLM versus 22 using TLM). For Olivia, RLM produced fewer sessions to criterion for one set of tasks (5 using RLM versus 6 using TLM). On the other set of tasks, Olivia required the same number of sessions to criterion for both prompting procedures (12 sessions). Number of errors to criterion for RLM was substantially less than for the traditional. Elijah had 233 errors to
criterion using TLM and 91 errors to criterion using RLM across both sets. For Olivia, RLM produced fewer errors to criterion across all sets (140) when compared to use of TLM (171).

In Phase 2, RLM required fewer sessions to reach criterion on all tasks for Owen than the traditional system (5 versus 11). For Alex, TLM resulted in one session fewer to criterion for Set 1 tasks, but RLM produced one session fewer to criterion for Set 2 tasks. Alex’s performance on Set 2 tasks also reflected considerable variability under both prompt-fading conditions. Number of errors to criterion for Owen using RLM was substantially less than for TLM across Sets 1 and 2 (2 versus 18).

Figure 3. Independent, correct responses for Owen during baseline and acquisition on two Sets of behaviors.
Number of errors to criterion for Alex using RLM was less for Set 1 (5 versus 7) and the same numbers of errors were noted under both conditions for Set 2 (2 errors).

Discussion
The purpose of this study was to assess the effects of two prompting procedures, a traditional system and a revised system, on skill acquisition. Both procedures were effective, however, number of errors to criterion was less for RLM for all participants across both task sets. Because it has been noted that error responding may be associated with the appearance of challenging behaviors and with a decline in motivation to perform (Billingsley,

![Graph showing independent, correct responses for Alex during baseline and acquisition on two Sets of behaviors.](image)
1998), the relatively lower number of errors generated by RLM might be considered a beneficial attribute by many educators. Given the relatively lower error rates generated by RLM and the fact that RLM required fewer sessions to criterion where substantial differences were found favoring one procedure or the other, it seems that RLM has the potential to be the better choice of the two methods when teaching tasks.

RLM may have produced more desirable results for at least two reasons. First, removing one step of the sequence could have allowed the students to achieve criterion at a faster rate. Second, verbal prompts never had the opportunity to develop as discriminative stimuli, thereby potentially increasing the efficiency with which transfer of stimulus control was achieved. Whatever the reason, the findings of this study are of value in that they could assist educators to select an instructional procedure that is efficient as well as effective. Our results also show that an investigator taught both procedures with high reliability, indicating that educators are likely to find classroom use of RLM at least as easy as the traditional procedure.

**Limitations and Suggestions for Future Research**

Information gathered outside of laboratory settings is critical to assist educators to meet the complex needs of students with autism. Efforts were made to establish methodological rigor in this investigation, however, use of the natural environment and associated variables presented several challenges.

It would have been desirable to have performed a social validity interview either prior to study implementation or at least at the end. As Schwartz and Baer (1991) stated, "social validity assessments should be conducted prospectively throughout an intervention, as well as at the end. Otherwise, consumers' concerns about the program cannot be answered in ways that defend the consumers, the program, and the discipline" (p. 201). Information could have been used to make program changes to reflect needs of consumers of the program. Replications and social validity assessments of RLM that would indicate its acceptability to teachers, instructional assistants and other classroom personnel await future research.

Characteristics of the tasks chosen may have been a factor in differences found between procedures employed. Two tasks were selected

**TABLE 1**

Phase 1: Efficiency Data for Traditional and Revised System of Least Prompts

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Sessions to Criterion</th>
<th>Number of Errors to Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Olivia</td>
<td>Elijah</td>
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<tr>
<td>Set 1</td>
<td></td>
<td></td>
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<tr>
<td>TLM</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>RLM</td>
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<td>9</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
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<tr>
<td>TLM</td>
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<td>22</td>
</tr>
<tr>
<td>RLM</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Total Across Participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TLM</td>
<td>40 sessions</td>
<td>404 errors</td>
</tr>
<tr>
<td>RLM</td>
<td>30 sessions</td>
<td>231 errors</td>
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<table>
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<th>Procedure</th>
<th>Sessions to Criterion</th>
<th>Number of Errors to Criterion</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Alex</td>
<td>Owen</td>
</tr>
<tr>
<td>Set 1</td>
<td></td>
<td></td>
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<td>4</td>
<td>4</td>
</tr>
<tr>
<td>RLM</td>
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<td>3</td>
</tr>
<tr>
<td>Set 2</td>
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<td></td>
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<tr>
<td>RLM</td>
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<td>2</td>
</tr>
<tr>
<td>Total</td>
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<tr>
<td>TLM</td>
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<td>11</td>
</tr>
<tr>
<td>RLM</td>
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<td>5</td>
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<tr>
<td>Total Across Participants</td>
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<tr>
<td>TLM</td>
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<td>27 errors</td>
</tr>
<tr>
<td>RLM</td>
<td>12 sessions</td>
<td>9 errors</td>
</tr>
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</table>
within each Phase that contained the same number of items and required the same response mode. Although every effort was made to equate difficulty level of tasks presented and students’ prior exposure to tasks, it was possible that tasks varied in difficulty and exposure, thereby influencing results. Students may have performed more effectively or efficiently if they had prior exposure to the task. In addition, various aspects of the tasks may have been more motivating to some students than others.

Many children with significant disabilities, particularly those with autism, may experience difficulty in understanding and responding appropriately to verbal information (Dettmer et al., 2000; Grandin, 1995; Schopler et al., 1995; Schuler, 1995; Walls et al., 1979). In addition, when spoken directions and instructions are provided, children with autism may only attend to selective parts of the message, failing to respond accurately to multicomponent stimuli (Schreibman, Kohlenberg, & Britten, 1986). If this, in fact, is the case, then the use of verbal prompts may not evoke the target behavior, or may do so slowly, and result in high rates of errors for some students.

This study is limited by a sample that included only young children diagnosed with autism. Future investigations might determine the extent to which similar results would be obtained when instructional tasks are comprised of multiple steps and where older children, and those who experience disabilities that do not include autism participate. As noted above, many students with autism do not readily respond to verbal stimuli. It could be that students who do not experience autism, and/or who prefer verbal language for communication, might be more responsive to the verbal prompts employed in the TLM procedure. It is possible, then, that this responsibility could result in verbal prompts becoming discriminative stimuli for such students more readily than those who participated in the present investigation. Depending on the speed with which TLM verbal prompts became discriminative for desired behavior, transfer of stimulus control might occur more or less rapidly under RLM than TLM instruction. Where discriminative properties developed, but did so relatively slowly, RLM would be expected to result in more rapid transfer.

On the other hand, if discriminative properties were acquired very quickly, it is possible that TLM would gain an advantage. These possibilities await exploration.

Because it is so widely recommended as an effective instructional method for students with severe disabilities, future research should also continue to examine ways by which efficiency of the system of least prompts might be maximized by analyzing additional parameters of the strategy. Finally, RLM should be compared with other prompt fading techniques that have been found to be effective and easy to implement (e.g., constant time delay).

References


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