RESEARCH ARTICLE

Evaluating tasks within a high-probability request sequence in children with autism spectrum disorder

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Abstract

Noncompliance is common in children with autism spectrum disorder (ASD). Antecedent interventions offer effective alternative to consequence procedures to decrease noncompliance. Although high-probability request sequences have been shown to be effective, previous research has not evaluated types of tasks within a high-probability request sequence. We compared the effects of relevant and irrelevant high-probability tasks on compliance to low-probability (low-p) requests in children with ASD. After high levels of compliance to low-p tasks were achieved across relevant and irrelevant conditions, fixed and variable presentations of high-probability requests were compared. Results showed that relevant high-probability requests increased the percentage of compliance more than irrelevant high-probability requests across participants as compared with baseline. For two of three participants, variable presentations of the high-probability requests resulted in higher percentages of compliance than fixed presentations. Results suggest that a variable presentation of relevant tasks should be considered within the high-probability request sequence.

1 | INTRODUCTION

Noncompliance can be problematic for typically developing children and for children with autism spectrum disorder. Although it may occur during the development of most children, noncompliance in those with autism spectrum disorder can be more prevalent and can affect skill acquisition, delay academic gains, and impede social interactions (Axelrod & Zank, 2012; Belfiore, Basile, & Lee, 2008; Davis, Brady, Williams, & Hamilton, 1992; Esch & Fryling, 2013; Lee et al., 2006; Ray, Skinner, & Watson, 1999; Riviere, Becquet, Peltret, Facon, & Darcheville, 2011). Engaging in noncompliance may impede social interactions by resulting in reduced levels of high-quality attention and fewer social initiations (Axelrod & Zank, 2012; Davis et al., 1992; Lee, Belfiore, Scheeler, Hua, & Smith, 2004; Mace et al., 1988).

Antecedent interventions have been used to address noncompliant behavior for individuals who have autism or related disorders. Antecedent interventions alter the environment prior to a problem behavior occurring (Cooper, Heron, & Heward, 2007) and can be implemented with little to no physical contact. Antecedent interventions include functional communication training, noncontingent reinforcement, and the high-probability (high-*p*) request sequence.

The high-*p* request sequence is an antecedent intervention during which an instructor presents a series of low effort, high-*p* requests to an individual immediately before presenting a low-probability (low-*p*) task (e.g., Ducharme & Worling, 1994; Mace et al., 1988). Tasks completed majority of presentations (i.e., with at least 80%; Mace et al., 1988) are classified as high-*p* tasks whereas those tasks complied with less often (i.e., 40% or below of opportunities) are generally classified as low-*p* tasks. A high-*p* request sequence has been has been shown to preemptively impede noncompliance to known low-*p* tasks (e.g., Axelrod & Zank, 2012; Belfiore et al., 2008; Davis et al., 1992; Ducharme & Worling, 1994; Kennedy, Itkonen, & Lindquist, 1995).

Mace et al. (1988) were the first to attempt to bridge the gap between basic and applied research by evaluating the effects of a high-*p* request sequence on the percentage of compliance to previously identified low-*p* tasks with four participants with developmental disabilities. It was found that the high-*p* request sequence increased compliance across conditions and participants. This initial study led to future extensions of the high-*p* request sequence (e.g., Ducharme & Worling, 1994; Esch & Fryling, 2013; Kennedy et al., 1995).

Although there is support using a high-*p* request sequence, several limitations have been noted. Although multiple investigations list the high-*p* tasks used (e.g., Axelrod & Zank, 2012; Davis et al., 1992; Davis & Reichle, 1996; Vostal & Lee, 2011), most studies provided only brief descriptions of the high-*p* tasks or include simple motor imitations (i.e., Ducharme & Worling, 1994; Kennedy et al., 1995; Mace et al., 1988; McComas, Wacker, & Cooper, 1998; Riviere et al., 2011; Romano & Roll, 2000; Zuluaga & Normand, 2008). Including description of high-*p* tasks has clinical importance for replication and implementation. Because most research omitted specific information regarding tasks, research has yet to address whether the type of task incorporated within the request sequence impacts compliance to the low-*p* task.

Consequently, it remains unknown whether the type of task embedded across the high-*p* procedure has an impact on noncompliant behavior. Although previous research has incorporated related or unrelated high-*p* and low-*p* tasks (i.e., Belfiore, Lee, Scheeler, & Klein, 2002; Davis & Reichle, 1996; Lee et al., 2004; Lee et al., 2006; Vostal & Lee, 2011), the two conditions have never been directly compared.

Further, research has yet to compare fixed compared with variable task presentation of high-*p* tasks on compliance to low-*p* tasks. Variant, or different, high-*p* tasks have been compared with invariant, or the same, high-*p* tasks within high-*p* sequence with individuals with emotional behavior disorders (Davis & Reichle, 1996). Results showed that variant and invariant conditions both increased compliance; however, compliance decreased during invariant

conditions after repeated exposure but maintained during variant presentations. The variant task presentations likely produced higher percentages of compliance over invariant task presentations due to the unpredictability of the variant sequence of requests. Lastly, few studies assessed social validity (i.e., Davis & Reichle, 1996; Ducharme & Worling, 1994), generalization of compliance (i.e., Davis et al., 1992; Ray et al., 1999), or maintenance (i.e., Belfiore et al., 2008; Davis et al., 1992; Davis & Reichle, 1996; Ducharme & Worling, 1994; Ray et al., 1999).

The purpose of the present study was to extend research evaluating tasks embedded within a high-p response sequence by directly comparing the effects of relevant and irrelevant high-p tasks on compliance to low-p requests. Second, a parametric analysis was then conducted on the number of high-p tasks presented prior to a low-p task. The effects of fixed high-p tasks were compared with a variable high-p task presentation on noncompliance behavior. Specifically, the study addressed the following questions: (a) What were the comparative effects on compliance to low-p requests when relevant or irrelevant requests were provided within a high-p request sequence? (b) What were the effects on compliance to low-p requests when a fixed or a variable number of requests are presented within a high-p request sequence (c) Will generalization of compliance occur with designated and restricted low-p tasks and with a novel instructor? (d) Will teachers, instructional aides, and college freshmen rate the procedures, goals, and outcomes of the study socially valid?

2 | METHOD

2.1 | Participants

Three students diagnosed with an autistic disorder by an outside agency participated. All participants attended a public-school program based upon principles of behavior analysis and had a history frequent noncompliant behavior (i.e., at least one occurrence of noncompliance per day) as reported by classroom teachers for at least 1 year. In addition, all participants were able to complete at least 25 tasks related to academics, self-help, or social skills with at least 80% accuracy and had 10 previously mastered tasks that were completed no more than a 40% as evidenced by weekly data collection. Informed consent was obtained prior to participation.

Across participants, the Gilliam Autism Rating Scale–Second Edition (Gilliam, 2006) was conducted prior to conducting the study, and all participants were rated as very likely to be diagnosed with autism. Harvey was a 10-year-old boy currently in a self-contained classroom diagnosed with autism. Due to Harvey's deficits in vocal communication, he used an augmentative and alternative communication device via the application Proloquo2go® via an iPod Touch®. Throughout the experiment, Harvey's augmentative and alternative communication device was present. Harvey's noncompliant behavior consisted of not engaging in the given task for 3 s, motor stereotypy, which included umping, tensing, and noncontextual laughing.

Jefferson was a 9-year-old boy in a self-contained classroom who was diagnosed with autism, attention deficit hyperactivity disorder, and anxiety disorder. Jefferson communicated using one to three word utterances. Jefferson's noncompliant behavior consisted of not engaging in the given task within 3 s, noncontextual laughter (the learner making an audible laughing sound when not related to the current assigned task), biting (the learner opening and closing his mouth onto another person or onto his own body or attempts to do so).

Gerald was a 12-year-old boy who was educated in a self-contained classroom diagnosed with autism and communicated using complete sentences. Gerald's noncompliant behavior consisted of not engaging in the given task within 3 s, noncontextual laughter (the learner making an audible laughing sound when not related to the current assigned task), and yelling (speaking above conversational level).

2.2 | Sessions

Experimental sessions occurred 1–4 times a day for 3–5 days a week per participant. During baseline and intervention phases, sessions were 15 min in duration, and each session was separated by at least 10 min.

2.3 | Setting and materials

The study took place at a public school in a designated area of each child's special education classroom. A table, a chair, and student-specific high- and low-p tasks were present. High-p and low-p tasks were identified per participant and were restricted to use in experimental sessions. A sampling of tasks assessed per participant are presented in Table 1. A Sony Bloggie Touch® handheld video camera was also used videotape sessions.

2.4 | Dependent variable and data collection

The dependent variable was the percentage of compliance to low-p tasks. Compliance was defined as the participant beginning the requested task within 3 s of the request and completing the task within 60 s (i.e., Ducharme & Worling, 1994). Nonexamples of compliance included not beginning the requested task within 3 s of the direction, not completing the task within the specified amount of time, or engaging in any behavior other than the behavior that was requested by the instructor (e.g., aggression, laughter, and stereotypy) for at least 10 s.

Data were summarized as the percentage of compliance to low-p tasks (e.g., Davis & Reichle, 1996; Mace et al., 1988; Romano & Roll, 2000; Zuluaga & Normand, 2008) and were calculated by dividing the number of low-p tasks complied with by the total number of low-p tasks presented and multiplied by 100%.

2.5 | Experimental design

An alternating treatment design with baseline was employed to compare compliance to low-p tasks across relevant and irrelevant high-p tasks within the high-p request sequence followed by the comparison of fixed and variable high-p task presentations. Sessions were semirandomized across conditions with no more than two consecutive presentations across sessions.

2.6 | Pre-experimental assessments

2.6.1 | Assessment of low-p and high-p tasks

The participants' primary instructional aides were given a Task Assessment Survey (available by the first author upon request) to identify at least 25 high-p and 10 low-p tasks per participant based. The primary researcher then observed each student in his classroom to verify noncompliance and noncompliance across tasks. Based on these observations, an empirical assessment of compliance to the tasks was conducted. The selected high-p and low-p tasks were presented to the participant 5 times each in a semirandom order without replacement to ensure that each task was presented once before any repetition of tasks. If the participant did not begin engaging in the task within 3 s of being presented, the next task was presented. Behavior-specific verbal praise was provided for compliance to high- and

TABLE 1 Low-p relevant and irrelevant task examples

	Low-p tasks	Relevant high-p tasks	Irrelevant high-p tasks
Harvey	Reading "stop"	Say "stop" Point to stop Say "ah"	Turn around Stand up Sit down
Gerald	Put toothpaste on toothbrush	Walk to sink Pick up toothpaste Pick up toothbrush	Clap your hands Give me a high five Touch your head
Jefferson	Write numbers 1–10	Pick up marker Write your name Write number 3	Touch your toes Tap the desk Give me a high five

Note. high-p: high-probability; low-p: low-probability.

low-*p* tasks. Low-*p* tasks were presented using a constant task presentation with an interresponse time of 3 s and noncompliance resulted in the presentation of a new task.

High-*p* tasks were defined as tasks complied with at least 80% of opportunities presented (e.g., Mace et al., 1988). Low-*p* tasks were defined as tasks complied with at least 40% or less of opportunities.

High-*p* tasks were also coded as relevant and irrelevant. Relevant tasks were defined as materials logically related to the low-*p* tasks whereas irrelevant tasks were defined as materials logically unrelated to the low-*p* tasks. For example, when the low-*p* task was put toothpaste on toothbrush, relevant high-*p* tasks included walk to the sink, pick up the toothpaste and toothbrush for Jefferson. Using putting toothpaste on toothbrush as the low-*p* task, the corresponding irrelevant tasks were one-step instructions (i.e., clap your hands, touch your head, and give me five).

2.6.2 | Baseline

During baseline, the instructor sat or stood 1–2 m in front of the participant and presented low-*p* tasks using a constant task presentation with an interresponse time of 3 s (e.g., Mace et al., 1988; Zuluaga & Normand, 2008). Prior to presenting tasks, the instructor established attending from the participant for at least 1 s. Contingent upon compliance to the low-*p* request, behavior-specific praise was provided (e.g., Ducharme & Worling, 1994). If the learner did not comply with the instruction, the instructor presented a different low-*p* request (Kennedy et al., 1995). As during the task assessment, low-*p* tasks were not presented twice consecutively within and across sessions.

2.6.3 | Relevant or irrelevant high-*p* task comparison

Across participants, following a decreasing trend in percentage of compliance during baseline, relevant or irrelevant high-*p* tasks were presented. As in baseline, attending was first established from the participant prior to presenting the task. Across comparisons, three high-*p* tasks were presented prior to one low-*p* task. Compliance to the low-*p* tasks received behavior-specific praise whereas noncompliance with the instruction or task resulted in removing the tasks and presenting a different request. High- and low-*p* requests were selected semirandomly without replacement from tasks identified via the task assessment to ensure that all 10 low-*p* requests were implemented once before any tasks were repeated.

2.6.4 | Relevant high-*p* task comparison

During the relevant high-*p* request sequence, three high-*p* tasks were presented prior to one low-*p* task. The high-*p* requests were presented every 3 s to the learner. If noncompliance occurred during any of the three high-*p* requests, noncompliance was not consequated, and the next task in the sequence was presented following the schedule.

2.6.5 | Irrelevant high-*p* request sequence

During the irrelevant high-*p* sequence, three irrelevant tasks were presented prior to one low-*p* task. The request sequence was implemented similarly as the relevant high-*p* request sequence. Compliance and noncompliance were consequated as during the relevant high-*p* request sequence.

2.6.6 | Fixed high-*p* request sequence or variable high-*p* request sequence comparison

Following high percentages of compliance over baseline in relevant or irrelevant conditions and a visual analysis of learner performance, the relevant or irrelevant condition that resulted in the greatest percentage of compliance for each participant was implemented in the same manner as previously described across a fixed or variable high-*p* task presentation. During the fixed high-*p* request sequence, three tasks were presented in a similar manner as relevant or irrelevant high-*p* sequence.

The procedure for the variable high-*p* request sequence consisted of presenting on average three high-*p* requests, which could range from one to eight tasks per session, averaged across five sessions. The order of the sequences and the specific high-*p* tasks were semirandomized without replacement after each use.

2.6.7 | Generalization

Three designated and restricted low-*p* tasks were used to assess generalization of compliance throughout treatment. In addition, generalization of compliance to the low-*p* tasks was assessed in a novel setting; however, the students' classroom settings were changed by their schools and generalization of compliance in a novel setting was not able to be assessed. Instead, generalization of compliance in the presence of a novel instructor was assessed. During generalization, there were no programed consequences for compliance.

2.6.8 | Maintenance

Follow-up data on compliance to low-*p* tasks were collected 3 and 4 weeks after evaluating the effectiveness fixed and variable high-*p* request sequence by the primary investigator. Maintenance sessions were conducted with the condition that resulted in the greatest reduction of noncompliance, either fixed or variable.

2.7 | Social validity

Social validity was assessed across procedures, goals, and outcomes with participant's classroom teachers and instructional aides and college freshman psychology students. Classroom teachers and instructional aides completed an eight-item survey with a 5-point Likert-type scale to rate the usability of the procedures and the validity of the goals. In addition, 16 college freshmen enrolled in a psychology course were asked to rate compliance across three videos of baseline and final treatment sessions. The video presentations were semirandomized.

2.8 | Interobserver agreement

Interobserver agreement data were collected across 35%, 36%, and 39% of sessions for Harvey, Jefferson, and Gerald, respectively. Data were calculated by a trained observer using point-by-point agreement by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Agreement data were high across sessions with a range of 90%–100% agreement and a mean of 96.2%.

2.9 | Treatment integrity

Treatment integrity data were collected across correct implementation of the procedures via video-recorded sessions. Data were calculated by dividing the number of steps correctly implemented by the total number of steps and multiplying by 100%.

Treatment integrity data were collected across 35%, 36%, and 39% of sessions for Harvey, Jefferson, and Gerald, respectively. Overall, treatment integrity data were high across sessions and participants with a range of 90%–100% and a mean of 96.5%. Interobserver agreement of treatment integrity was collected across 38%, 39%, and 40% of the sessions that were assessed for treatment integrity for Harvey, Jefferson, and Gerald, respectively. Agreement data of treatment integrity data remained high with a mean of at least 98% (range, 94%–100%) across participants.

3 | RESULTS

Figure 1 shows the percentage of compliance to low-*p* tasks for Harvey (top), Jefferson (middle), and Gerald (bottom), respectively, across baseline, relevant and irrelevant, relevant-fixed and relevant-variable, generalization, and maintenance conditions. During baseline for Harvey, the mean percentage of compliance was low and variable. Once relevant and irrelevant conditions were introduced, compliance increased above baseline. Although variable, percentage of compliance to low-*p* tasks was higher in the relevant condition compared with the irrelevant task presentation. When relevant-fixed and relevant-variable task presentations were implemented, compliance was greater during relevant-fixed task presentation. Generalization of compliance to low-*p* tasks was higher during novel tasks than a novel
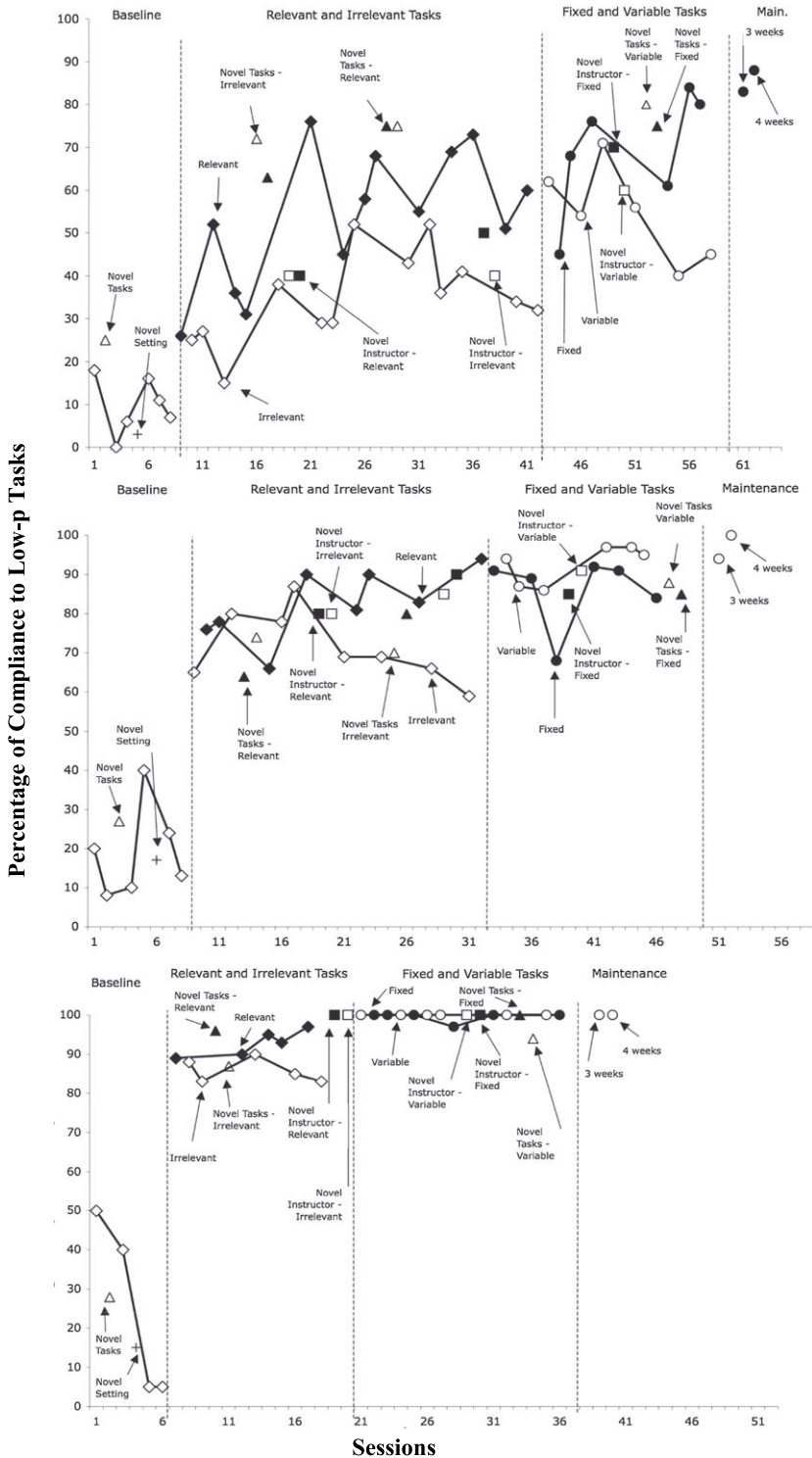
FIGURE 1 Percentage of compliance to low-probability (low-*p*) tasks across baseline, relevant and irrelevant, fixed and variable task presentations, and maintenance for Harvey (top), Jefferson (middle), and Gerald (bottom)

instructor following the introduction of relevant and irrelevant task presentation. Across relevant-fixed task presentations, the percentage of compliance maintained across 3- and 4-week probes.

For Jefferson, as shown in Figure 1, compliance during baseline was low and variable. Similar to Harvey, relevant task presentations produced the highest percentage of compliance once relevant and irrelevant task presentations were introduced. Once relevant-variable and relevant-fixed tasks presentations were introduced, high levels of compliance to low-p tasks were observed although relevant-variable task presentations produced a slightly higher percentage of compliance to low-p tasks. Generalization of compliance to low-p tasks was higher than baseline in the presence of novel tasks and novel instructors although marginal differences between the two were observed. During maintenance, relevant-variable tasks were continued for Jefferson. During these sessions, Jefferson's compliance remained high.

As shown in Figure 1, Gerald's percentage of compliance to low-p tasks decreased across baseline sessions. As demonstrated across Harvey and Jefferson, compliance was greater during the relevant tasks than the irrelevant task presentations. Once relevant-fixed and relevant-variable task presentations were implemented, compliance remained near 100% across both conditions. Generalization of compliance to novel tasks and to a novel instructor was higher than observed during baseline. Compliance during maintenance sessions for Gerald remained high at 100%.

Outcomes of a 5-point Likert-type scale social validity surveys are presented in Table 2. The survey indicated that teachers and instructional aides found the description of the procedures understandable and that they would be able to implement the task assessment and implement relevant and irrelevant tasks. Although rated favorably, the fixed task presentation resulted in a higher mean. A chi-square goodness-of-fit test was performed to determine whether the college students' accurate identification of compliance levels displayed in the videos was unlikely to occur by chance responding. Identification of compliance was accurately identified by all 16 college freshmen across two participants, X^2 (1, N = 16) = 16, p < 0.05 and by 14 out of 16 college freshmen across the third participant, X^2 (1, N = 16) = 9, p < 0.05.

4 | DISCUSSION

The purpose of the current research was to assess the comparative effects of compliance to low-p requests when relevant and irrelevant tasks were presented within the high-p request sequence followed by an evaluation of fixed

TABLE 2 Social validity survey results

Social validity survey	Mean	Range
How well do you understand the procedures?	4.6	4–5
With training, would you be able to implement the procedures to identify compliant and noncompliant tasks?	4.8	4–5
With training, would you be able to implement the procedures with the relevant or irrelevant tasks?	4.8	3–5
With training, would you be able to implement the variable task presentations?	4.1	4–5
	Relevant (*n* of responses)	Irrelevant (*n* of responses)
Do you find the relevant or the irrelevant conditions easier to implement?	15	4
Which condition, relevant or irrelevant, do you think would be more effective?	13	6
	Fixed (*n* of responses)	Variable (*n* of responses)
Do you find the variable or the fixed conditions easier to implement?	15	4
Which condition, fixed or variable, do you think would be more effective?	6	13

or variable task presentations. The current research expanded upon previous research by comparing the effects of relevant and irrelevant, fixed and varied high-*p* requests within the high-*p* request sequence (i.e., Davis & Reichle, 1996; Kennedy et al., 1995; Romano & Roll, 2000). Additionally, the current study built upon previous research by assessing generalization, maintenance, and social validity.

We found that that relevant high-*p* tasks used within the high-*p* request sequence were more effective than irrelevant on increasing compliant behavior to low-*p* tasks. The results showed that, compared with compliance during baseline, percentage of compliance to low-*p* requests increased when relevant or irrelevant requests were provided; however, compliance was highest in the presence of relevant tasks across participants.

For two participants, the highest increases in compliance over baseline occurred in the relevant-variable task presentations. These results are important because it demonstrates that a variable number of high-*p* tasks may be more effective than fixed on compliant behavior although both variable and fixed task presentation resulted in high levels of compliance to low-*p* tasks. However, results are tentative given the number of tasks assessed. The current investigation evaluated presenting three tasks or a mean of three tasks (range, 1–8). Future research should explore the effects of different number of tasks embedded in a high probability response (HPRS).

In the current study, noncompliance was not explicitly consequated, but compliance to the low-*p* tasks received behavior-specific praise. It is possible that this procedure served as an abolishing operation for attention during the low-*p* tasks because the increased attention for compliance to low-*p* and high-*p* tasks decreased the reinforcing effectiveness of attention for noncompliance. Other motivational variables that may account for the outcomes include an abolishing operation of the aversiveness of low-*p* tasks. Because high-*p* tasks result in an increase of reinforcement, the increase of reinforcement may abolish the aversiveness of low-*p* tasks.

In addition, generalization of compliance to low-*p* tasks was higher than observed during baseline per participant. By creating indiscriminable conditions with the relevant-variable task presentations, perhaps generalization of compliance to low-*p* tasks was enhanced (Stokes & Baer, 1997). Across participants, percentage of compliance during maintenance sessions remained high and maintained 3 and 4 weeks after treatment sessions concluded.

Social validity was assessed by teachers and instructional aides of the students and by college freshmen. Teachers and instructional aides reported that the procedures and goals were socially valid. In addition, college freshmen rated the outcomes as socially valid as well.

There were several limitations of the current research. Relevant-fixed and relevant-variable task presentations were compared after the high-*p* and low-*p* tasks were exposed to relevant and irrelevant task presentations. It is possible that previous exposure to these tasks in the relevant and irrelevant high-*p* request sequences affected compliance levels during fixed and variable conditions. Future research could attempt to account for the potential sequence effect of the relevant-fixed and relevant-variable task presentations in the current research.

There are several areas that future research should explore. Future research should replicate the current study with different ages and populations. Future research should also assess relevant-variable high-*p* request sequence in the natural environment (i.e., classroom and home) with typical intervening agents (i.e., teachers or instructional aides and parents).

In addition, future research should also assess methods to fade the use of relevant-fixed task presentations. Relevant-variable task presentations did not increase compliance more than relevant-fixed task presentations for one participant. It should be explored whether the high-*p* procedure could be faded slower with a more gradual introduction of the relevant-variable task presentations. The relevant-variable task presentations used in the current research ranged from one to eight high-*p* tasks. For some individuals, eight high-*p* tasks may have been too large of a step from three high-*p* tasks, and one high-*p* task may be too few between two low-*p* tasks.

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