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A comparison of prompting hierarchies on the acquisition of solitary play and vocational skills

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A Comparison of Prompting Hierarchies on the Acquisition of Solitary Play and Vocational Skills

A Thesis Presented

by

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The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements for the degree of

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Bouvé College of Health Sciences Graduate School

Thesis Title: A Comparison of Prompting Hierarchies on the Acquisition of Solitary Play and Vocational Skills

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A Comparison of Prompting Hierarchies on the Acquisition of Solitary Play and Vocational Skills

by

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Submitted in partial fulfillment of the requirements for the degree of

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Abstract

The present study compared two variations of a 2-second delay prompting hierarchy on the acquisition of solitary play and vocational skills. The most to least with a 2-second delay hierarchy (MTL 2 s delay) instructed with fading physical prompts. A simplified version, referred to as manual guidance with a 2-second delay (MG 2 s delay), instructed with a static prompt and constant time delay. All participants acquired the play and vocational tasks, and the rate of acquisition was comparable for all tasks taught in both conditions. The rate of acquisition was similar between fading prompts and not fading prompts while maintaining a constant time delay.

A Comparison of Prompting Hierarchies on the Acquisition of Solitary Play and Vocational Skills

There is widespread awareness of autism spectrum disorders (ASD) around the globe. Early treatment of ASD will have more favorable results than will treatments that occur later. One of these treatments, applied behavior analysis, has been shown to ameliorate the symptoms of ASD (Myers & Johnson, 2007). Moreover, Lerman, Vorndran, Addison, and Kuhn (2004) determined that most typically developing children can understand classroom work solely with teacher instruction, materials, and occasional social reinforcement. Contrarily, MacDuff, Krantz, and McClannahan (2001) discovered that teacher instruction combined with task materials may not be enough for learning to take place in people diagnosed with ASD. However, certain learning cues, such as prompts, can enable people diagnosed with ASD to learn new skills (MacDuff et al., 2001). Prompts are auxiliary antecedent stimuli that can take many forms, such as physical guidance, gestures, models, or verbal cues (Green, 2001). When prompts are used as a teaching tool, fading them becomes necessary to encourage independence (Lerman et al., 2004). Prompting procedures should continue to be evaluated to facilitate the greatest potential of learning.

Behavior chains are sequences of responses in which each response produces a stimulus change that functions as conditioned reinforcement for that response and as a discriminative stimulus for the next response in the chain. Chains can include almost anything from brushing one's teeth to building a structure with blocks. The process of breaking these chains into smaller, teachable units is called task analysis (Cooper, Heron, & Heward, 2007). Task analyses are used to teach behavior chains, and Spooner and Spooner (1984) concluded that task analyses may

produce better learning by examining and testing the different prompting variations used within the task analysis.

Prompts are supplementary antecedent stimuli used to occasion correct responding in the presence of a discriminative stimulus that will eventually control the behavior (Cooper, Heron, & Heward, 2007). Response prompts operate directly on the response, and can involve verbal instructions, modeling, or physical guidance (Cooper, Heron, & Heward, 2007). In a review study, Demchak (1990) concluded that the use of response prompts can increase the probability that a particular behavior will occur, and, therefore, can provide more opportunities for differential reinforcement of that behavior. It is important that prompts be faded, so that the response is occasioned by natural cues. Billingsley and Romer (1983) agreed that learned behaviors should eventually exist in the presence of natural stimuli and be maintained by natural consequences, and that stimulus control should be shifted from the prompt to the naturally occurring stimulus using some type of prompting hierarchy.

Wolery and Gast (1984) defined four procedures for transferring stimulus control from response prompts to natural stimuli. These procedures are most-to-least prompts, least-to-most prompts, graduated guidance, and time delay. Most-to-least prompts involve gradually reducing the amount of physical assistance provided as training progresses from trial to trial and session to session. Least-to-most prompts involve giving the participant an opportunity to perform the response with the least restrictive prompt on each trial. The participant receives greater degrees of assistance until a correct response is emitted. Graduated guidance involves providing as needed assistance that is immediately faded out to transfer stimulus control; and time delay uses variations in the time intervals between the presentation of the natural stimulus and the presentation of the response prompt. The two types of time delay are progressive and constant.

Progressive time delay starts with a zero-second delay between the presentation of the natural stimulus and the response prompt, and this delay is gradually and systematically extended.

Constant time delay applies a fixed time delay between the presentation of the natural stimulus and the presentation of the response prompt (Cooper, Heron, & Heward, 2007).

Wacker and Berg (1984) transferred stimulus control using prompts when they taught complex vocational sequencing tasks to intellectually disabled adults using picture prompts. Horner and Keilitz (1975) also showed that prompting in the form of verbal instruction, modeling, demonstration, and physical assistance played a vital role in developing improved toothbrushing behavior in eight participants. Schleien, Wehman, and Kiernan (1981) demonstrated that the use of prompts and social reinforcement allowed for three intellectually disabled participants to learn an age-appropriate darts game. Griffen, Wolery, and Schuster (1992) discovered not only that many independent living skills desired for the intellectually disabled population are chained tasks, but that the use of constant time delay procedures combined with social reinforcement was effective at teaching chained cooking skills.

Steege, Wacker, and McMahon (1987) contrasted the traditional least-to-most prompting sequence with a prescriptive method that involved providing the participant with a level of assistance that had previously been sufficient to occasion responding according to behavioral assessment data. It was concluded that although the prescriptive sequence was more efficient than the traditional least-to-most sequence, both procedures were equally effective. Given the complex procedure of the prescriptive sequence and its difficulty of implementation, it was also suggested that the least-to-most sequence was more practical.

Demchak (1990) reviewed research on fading prompts. Four methods of fading prompts were defined as (1) least-to-most, (2) most-to-least, (3) graduated guidance, and (4) time delay.

Demchak (1990) concluded from several articles that most-to-least prompting appeared more efficient than least-to-most prompting when looking at the rate of response acquisition to teach a variety of different skills. It was also concluded from numerous studies that constant time delay is equally as effective as progressive time delay and easier to implement (Demchak, 1990). Miller and Test (1989) determined that most-to-least was equally effective as constant time delay, constant time delay was more efficient than most-to-least prompting in terms of instructional time and number of errors. McDonnell and Ferguson (1989) made an opposing conclusion that both most-to-least was more efficient than constant time delay. Several studies are in agreement that both most-to-least and constant time delay are more effective than least-to-most prompting. McDonnell (1987) concluded that constant time delay was more effective than least-to-most prompting when teaching four severely handicapped high school students to purchase items from a convenience store. Findings of Schoen and Sivil (1989) indicated a small but noticeable advantage of using constant time delay rather than least-to-most prompting. Additionally, the use of time delay was more efficient than least-to-most prompting in terms of the rate of acquisition (Bennett, Gast, Wolery, & Schuster, 1986). Doyle, Wolery, Gast, and Ault (1990) conducted an investigation leading to the conclusion that constant time delay was superior to least-to-most prompting in that constant time delay resulted in decreased instructional time, as well as fewer trials to criterion and errors.

Libby, Weiss, Bancroft, and Ahearn (2008) compared most-to-least and least-to-most prompting on the acquisition of solitary play skills. Some participants failed to learn with the least-to-most procedure, and the most-to-least sequence was more effective and resulted in fewer errors than least-to-most. With the addition of constant 2-second time delay to the most-to-least sequence, response acquisition was faster than the most-to-least sequence without a delay, even

though more errors occurred. It was concluded that the use of MTL 2 s delay is the best default prompting strategy, and that individual differences are expected to occur among learners (Libby et al., 2008).

Prompts are only as valuable as their ability to successfully transfer stimulus control to the natural stimulus. Most prompting strategies used today are successful at transferring stimulus control, but some strategies are easier to implement than others. Most research on prompting today continues to focus on discovering easier, more efficient, and more effective ways to teach behavior chains. Demchak (1990) stated that procedures leading to task mastery sooner should preferably be used. Libby, Weiss, Bancroft, and Ahearn (2008) concluded both that the most-to-least procedure was more effective than the least-to-most procedure and that the most-to-least procedure was more efficient when paired with a constant time delay. Prompting procedures involving fewer prompts are also likely easier to implement. Therefore, a simpler version of a MTL 2 sec delay prompting strategy with a static prompt paired with a constant time delay might be easier to implement and be as effective as the MTL 2 sec delay prompting strategy that fades physical prompts.

Method

Participants

Three young girls and one man participated in this study. All participants were diagnosed with an intellectual disability and attended the same school or the affiliated adult services program. Each of the four participants possessed the necessary pre-requisite skills to perform the designated tasks and all were selected based on their ability to acquire skills using physical prompts.

Greta was a 14-year-old adolescent girl diagnosed with Angelman Syndrome. Greta displayed severe deficits in expressive language skills, and she used American Sign Language (ASL) and the Picture Exchange Communication System[®] to communicate. In the three years Greta attended the school, she had regularly used task analyses for self-care. Wendy and Claire were both 15-year-olds diagnosed with Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS). Both Wendy and Claire successfully used verbal speech to communicate their wants and needs. Tasks analyses for self-care, cooking, and leisure were present in both Wendy and Claire's education programs during this study, and both adolescents had extensive past exposure to task analyses. Greta, Wendy, and Claire all lived in the same residence. Fred was a 37-year-old man diagnosed with ASD. He displayed severe deficits in expressive language skills and used ASL and a communication book with words and images to communicate. In the past, he had used task analyses for self-care, and his service plan at the time of this study included task analyses for self-care and cooking. He resided at a residence with other men and women having diagnoses similar to his.

Setting and Materials

Academic rooms in the residences and classrooms in the school served as this study's setting. The room contained two chairs and a table, as well as the task materials relevant to the condition. Materials included four 12-step Lego[®] play constructs. Each construct consisted of the same size and shape Lego[®] baseboard and eleven Lego[®] pieces associated with a specific placement on the baseboard. Two of these baseboards were green, one was yellow, and the other one was red. The two green baseboard constructs were not used simultaneously at any point with any participant. Completed play constructs are shown in Figure 1. Materials also included two 12-step vocational constructs, referred to in this study as chess king and queen pieces. They both

involved the assembly of a screw and bolt with different nuts and washers. Both play and vocational chains were 12-step task analyses, and were of a comparable level of difficulty. Completed vocational constructs are shown in Figure 2.

Independent and Dependent Variables

The independent variables were two prompting variations; MTL 2 s delay and manual guidance with a 2-second delay (MG 2 s delay). MTL 2 s delay instructed using manual guidance at the hand, a 2 s delay then manual guidance at the forearm, a 2 s delay then manual guidance at the upper arm, a 2 s delay then light touch to shadowing, and independence. MG 2 s delay instructed using first manual guidance at the hand, a 2 s delay then manual guidance at the hand, and independence. For both hierarchies, a participant was able to reach independence on a step in four trials. The number of sessions and trials to master a construct were the dependent variables.

Design and Procedure

An alternating treatments design was used in this study. The experimenter used MTL 2 s delay or MG 2 s delay to train the task analyses. Each procedure was paired with a different construct for both experiments, and the constructs were counterbalanced across participants and conditions. First, the experimenter trained the participants simultaneously on two play constructs, with one construct being trained using MTL 2 s delay and the other with MG 2 s delay. Once the two constructs were mastered, the experimenter trained the next two play constructs in a similar fashion, followed by the two vocational constructs.

Prior to the study, the experimenter conducted edible preference assessments for each participant (Fisher et al., 1992). At the beginning of each session, the participant chose between

two to three highly preferred edibles, and that item was used to reinforce correct responding during that session.

Sessions consisted of one probe trial followed by 10 training trials. Probe trials served as an opportunity for a participant to display independent responding, not to prescribe training steps. During the probe trial, the items were presented randomly in front of the participant and the experimenter established attending. After the initial S^D of “Let’s build Legos®!” or “Let’s build a chess piece!”, items remained for 15 seconds or until the participant made an error. The experimenter provided no prompting or reinforcement.

During the training trials, the items were presented randomly in front of the participant and the experimenter established attending. After the initial S^D of “Let’s build Legos®!” or “Let’s build a chess piece!”, the experimenter followed the pre-determined prompting strategy for the training step and did not complete untrained steps. The experimenter provided a preferred edible and verbal praise for correct responding on the training step. Two successful trials at a prescribed prompt resulted in an increase to the next less-restrictive prompt level. An increase to the next training step occurred if the participant successfully completed the previous step independently for two consecutive trials. Errors on the training step resulted in immediate hand over hand correction and no reinforcement. Two consecutive errors on the training step resulted in an increase in one prompt level. Two consecutive errors on a previously mastered step resulted in retraining that step.

A construct was considered to be mastered when all steps in a chain were completed independently for two consecutive trials. If performance of a probe trial was 100% independent and accurate, the experimenter conducted another probe trial. If the participant completed the

construct independently again, the construct was mastered. Generalization probes determined if independent responding maintained with a novel instruction and in a different setting.

Response Measurement and Inter-observer Agreement

All sessions were videotaped in order to obtain measures of inter-observer agreement (IOA) and procedural integrity. IOA was calculated by dividing the number of agreement intervals by the total number of intervals and multiplying by 100. IOA was collected by a trained observer on 33% of sessions across participants. IOA ranged from 94% to 98% with an average of 96% agreement across all participants' play and vocational tasks.

Procedural integrity was also collected by the experimenter in all sessions and by a second observer in 33% of sessions, with a goal of 80% or greater. For each trial within a session, a second observer scored (1) whether or not correct reinforcement was given for correct responding on the training step, (2) if all prescribed prompts were followed, (3) if the necessary materials were available, and (4) whether or not untrained steps were completed. Procedural integrity was calculated in the same way as the IOA. Procedural integrity averaged 99% agreement in 33% of sessions.

Results

All participants acquired all constructs using both hierarchies. Three of the participants (Wendy, Claire, and Fred) acquired all constructs in fewer or equal sessions using MTL 2 s delay than with MG 2 s delay. Although Greta's vocational construct was mastered more rapidly with MG 2 s delay, the difference in acquisition was only one session.

Figure 3 shows the acquisition of the tasks for Greta. She mastered the first play task with MTL 2 s delay in 28 sessions and MG 2 s delay in 33 sessions. Her second play task was

mastered in 16 sessions with MTL 2 s delay and 20 sessions with MG 2 s delay. She mastered the vocational construct with MG 2 s delay in 12 sessions and the construct with MTL 2 s delay in 13 sessions. The greatest differences in acquisition between the prompting hierarchies across all participants in this study were seen in Greta's play tasks. She mastered her first and second play tasks more rapidly with MTL 2 delay than with MG 2 s delay, and with a 45 and 42 trial difference in acquisition, respectively. Figure 4 shows the trials to mastery for Greta. She acquired the play chains using MTL 2 s delay in 277 and 152 trials, and 322 and 194 trials using MG 2 s delay. The vocational task was acquired in 130 trials using MTL 2 s delay and 116 trials using MG 2 s delay.

Figure 5 shows Wendy's acquisition. She mastered the first two play constructs with a 1 session difference (MTL 2 s delay in 8 sessions and MG 2 s delay in 9 sessions). The second play constructs were also mastered with a 1 session difference (MTL 2 s delay in 10 sessions and MG 2 s delay in 11 sessions). She mastered both vocational constructs in 6 sessions. Figure 6 shows Wendy's trials to mastery for all constructs. She acquired the play chains using MTL 2 s delay in 80 and 96 trials, and 84 and 83 trials using MG 2 s delay. She also acquired both vocational constructs with both prompting variations. She acquired the vocational task in 65 trials using MTL 2 s delay and 56 trials using MG 2 s delay.

Claire's acquisition is shown in Figure 7. She mastered the first set of play constructs with a 2 session difference (MTL 2 s delay in 10 sessions and MG 2 s delay in 12 sessions). She acquired the second play task more rapidly with MTL 2 s delay but acquisition was still comparable (MTL 2 s delay in 9 sessions and MG 2 s delay in 12 sessions). Similar to Wendy, Claire mastered the vocational constructs in the same amount of sessions. Figure 8 shows her trials to mastery. Claire acquired the play chains using MTL 2 s delay in 96 and 83 trials, and

112 and 112 trials using MG 2 s delay. She also acquired both vocational constructs with both prompting variations. She acquired the vocational task in 61 trials using MTL 2 s delay and 70 trials using MG 2 s delay.

Figure 9 shows Fred's acquisition. He mastered both sets of play constructs and the vocational constructs in 6 sessions for both prompting hierarchies. Figure 10 shows his trials to mastery. The play chains were acquired in 58 and 60 trials with MTL 2 sec delay, and 59 and 60 trials using MG 2 s delay. He also acquired both vocational constructs with both prompting variations. He acquired the vocational task in 51 trials using MTL 2 s delay and 58 trials using MG 2 s delay. All participants showed generalized responding in a novel setting and with a novel instructor.

Table 1 shows the total number of sessions, the total errors, and the average number of errors per session with the two prompting hierarchies. Two participants (Wendy and Claire) made more errors with MG 2 s delay than with MTL 2 s delay, but the average number of errors per session was similar. The other two participants (Greta and Fred) made more errors with MTL 2 s delay than with MG 2 s delay, but the average number of errors per session was also similar.

Discussion

In this study, all participants mastered all constructs with each of the prompting hierarchies used. For each participant, the rate of acquisition was comparable for both prompting variations. The results show that fading prompts was unnecessary for 3 of the 4 participants. Greta learned the vocational construct more rapidly with MG 2 s delay, but with only a 14 trial difference from the MTL 2 s delay. If instructors can teach students a skill without fading

prompts, it may be easier for instructors to implement, and, therefore, levels of procedural integrity may be higher.

Prompting procedures that are easier for instructors to implement are better for several reasons. First, it is likely that the procedure will be implemented more often if the instructor is confident and comfortable with it. Second, it is also likely that there should be fewer mistakes and higher procedural integrity if a procedure is easier to implement. Third, the student will likely learn more skills if procedures are implemented more often and correctly. Demchak (1990) stated that procedures leading to task mastery sooner should preferably be used, so if a student can learn more skills because a procedure is implemented more often and correctly, that procedure should be the preferred one. Because methods for teaching the intellectually disabled population are constantly being improved, the search for more effective and efficient teaching strategies is ongoing.

Although all participants displayed comparable rates of acquisition for both prompting hierarchies, one limitation of this study may have been the ceiling effect that one participant, Fred, displayed. Ceiling effects may have contributed to the near identical effect that the prompting variations had on his acquisition. It is possible that there may have been greater differences between the prompting hierarchies had the tasks taken longer to acquire. Greta had drastically slower rates of acquisition relative to Fred, and acquisition remained comparable between prompting hierarchies. Libby, Weiss, Bancroft, and Ahearn (2008) concluded that the use of MTL 2 s delay was the best default prompting strategy and produced rapid acquisition. This study furthers that finding by suggesting that MG 2 s delay might be more effective and efficient than MTL 2 s delay for many learners.

Future research can compare acquisition of different tasks, such as self-care skills, when taught using these different prompting hierarchies. Additionally, by examining in-vivo procedural integrity of instructors implementing both MTL 2 s delay and a simplified MG 2 s delay, it can be assessed whether a simplified prompting hierarchy results in fewer teacher errors. As evidenced by the results of the current study, prompt fading may be unnecessary for some individuals.

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Table 1

Errors

Participants	MTL 2 s delay			MG 2 s delay		
	Total Sessions	Total Errors	Average Errors per session	Total Sessions	Total Errors	Average Errors per session
Greta	57	217	3.81	65	233	3.58
Wendy	24	43	1.79	26	58	2.30
Claire	26	64	2.46	31	94	3.03
Fred	17	34	2.00	18	34	1.89

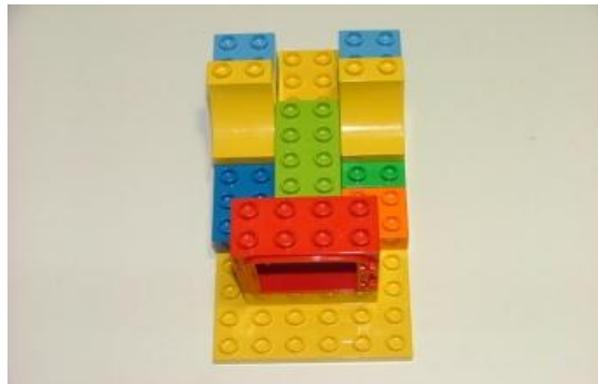
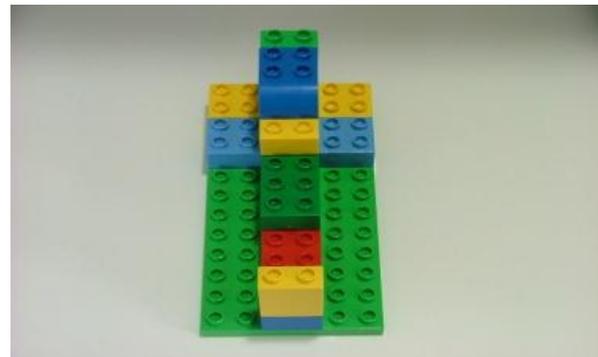
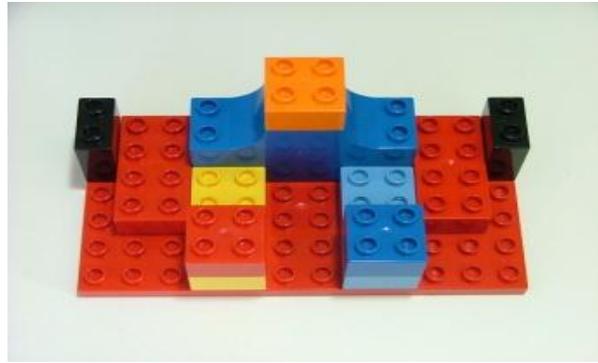


Figure 1: Completed play constructs.



Figure 2: Completed vocational constructs.

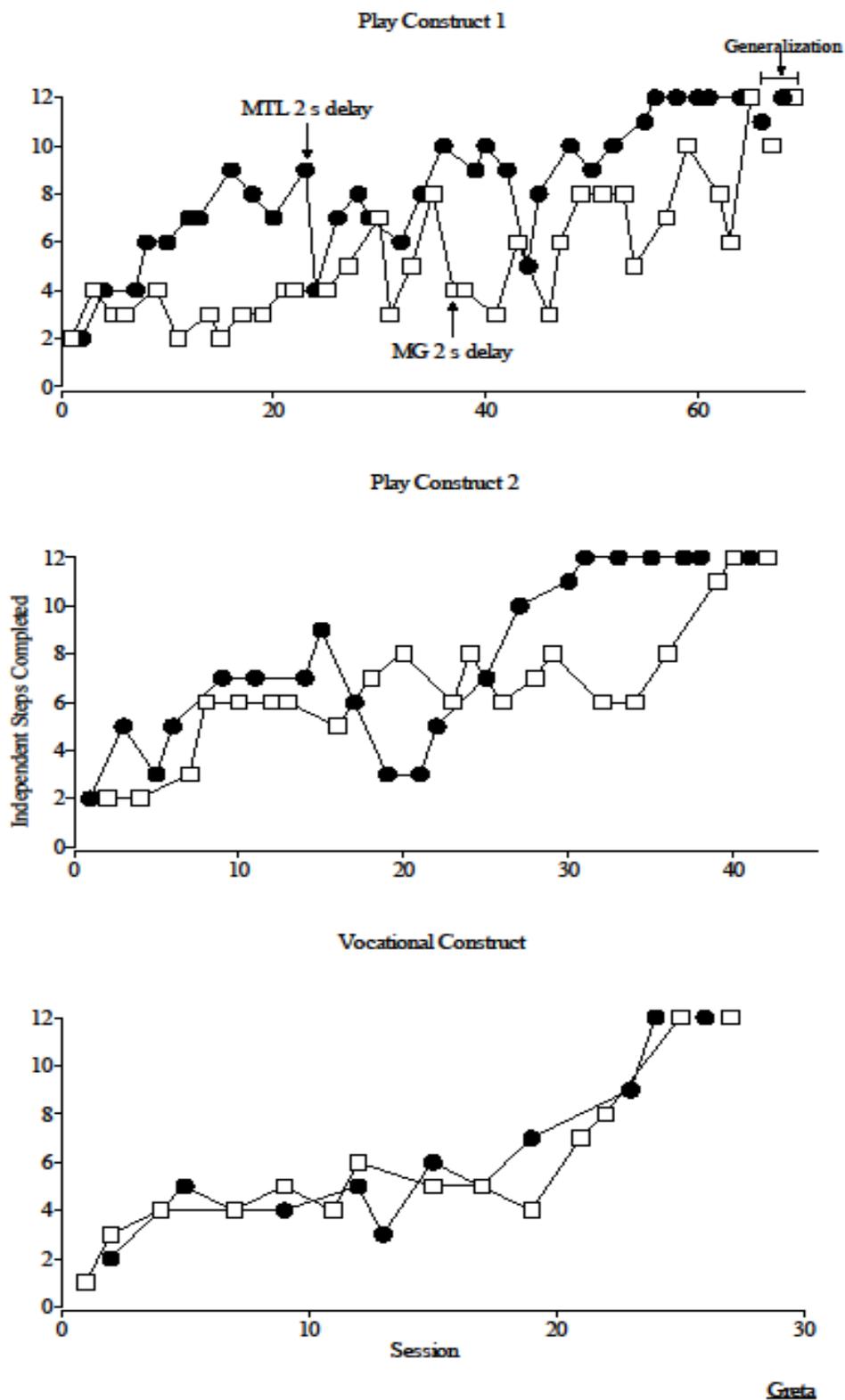
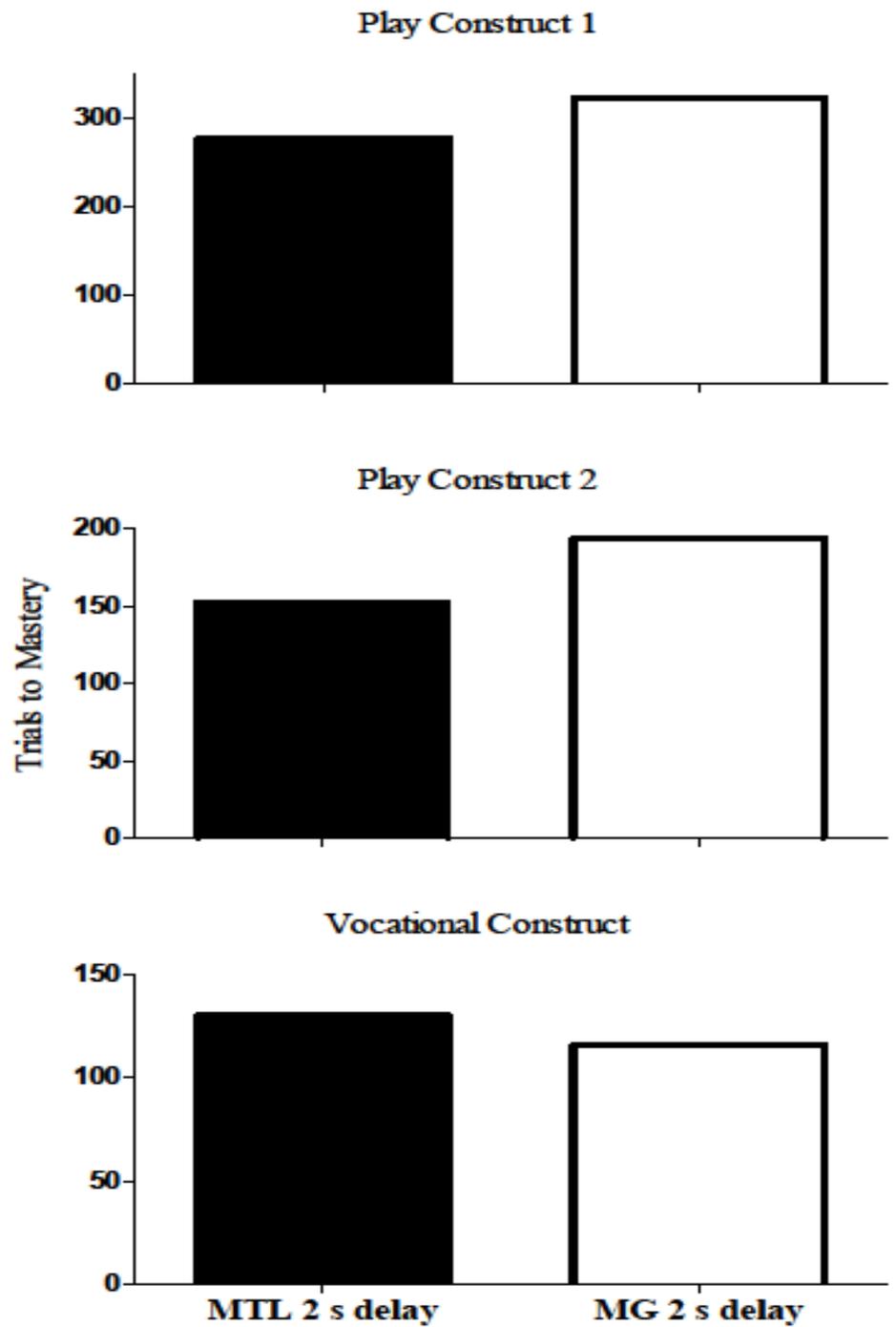


Figure 3: Independent steps completed for both play tasks and the vocational task for Greta.



Greta

Figure 4: Trials to mastery for all tasks for participant Greta.

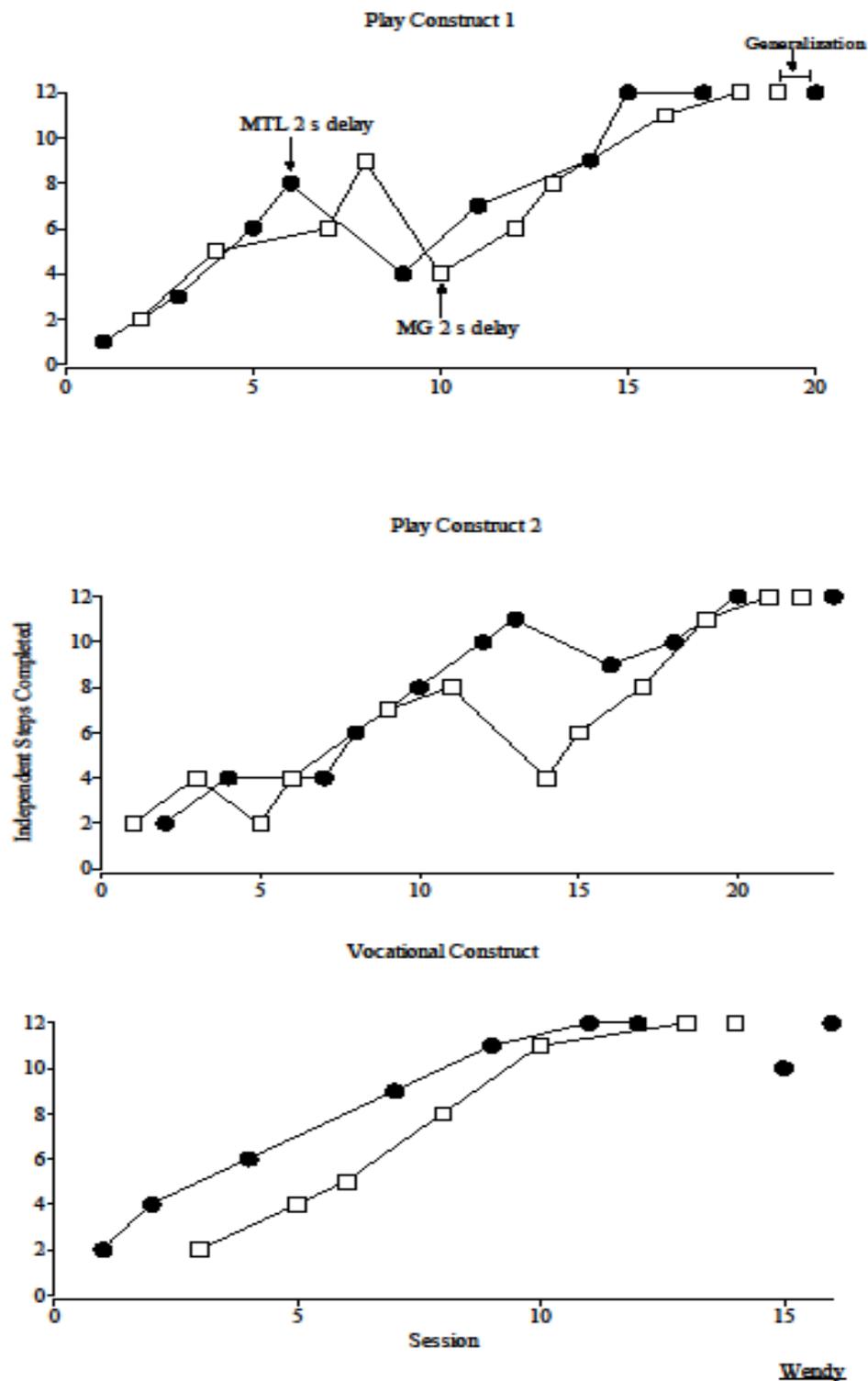
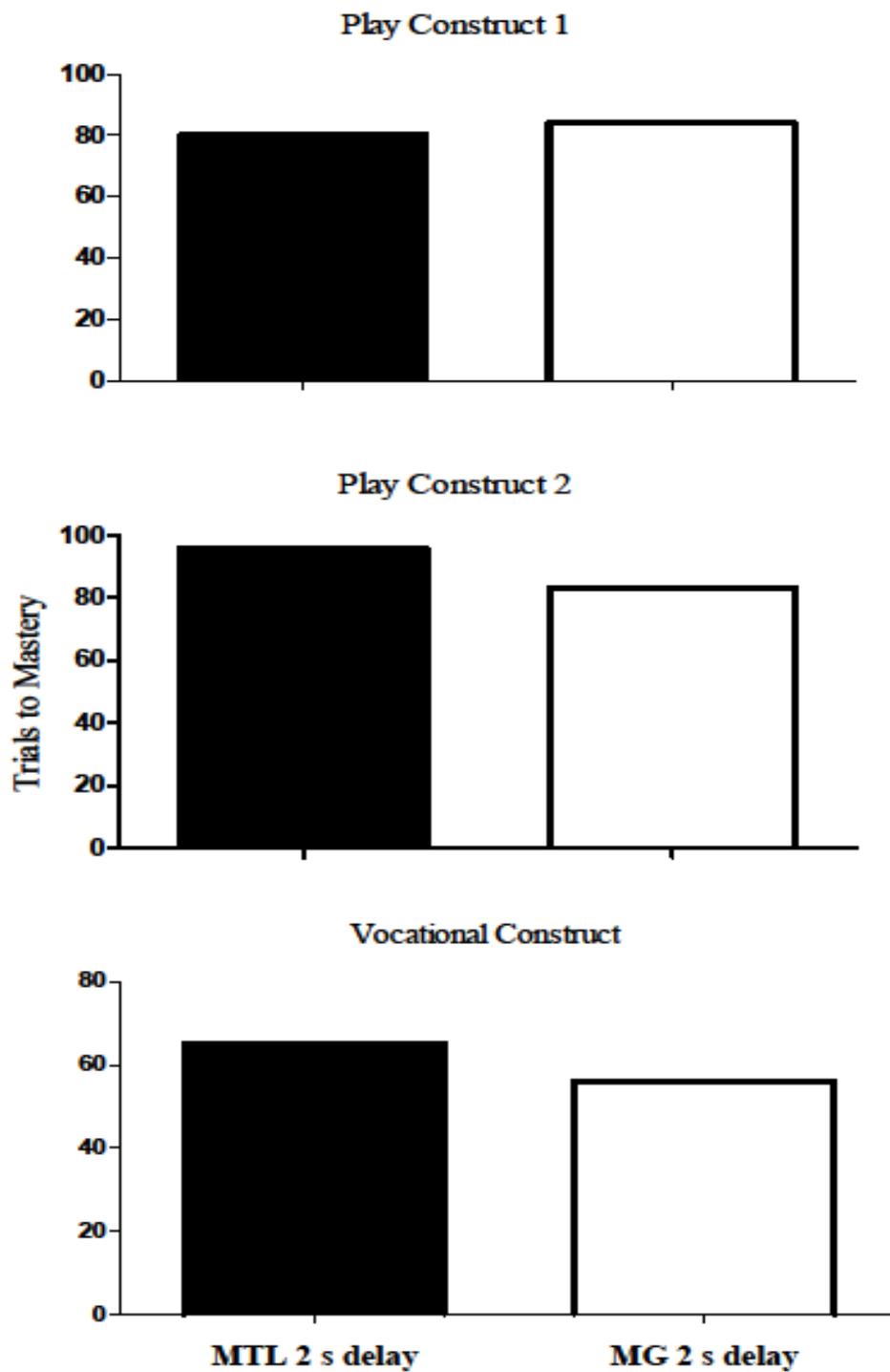


Figure 5: Independent steps completed for both play tasks and the vocational task for Wendy.



Wendy

Figure 6: Trials to mastery for all tasks for participant Wendy.

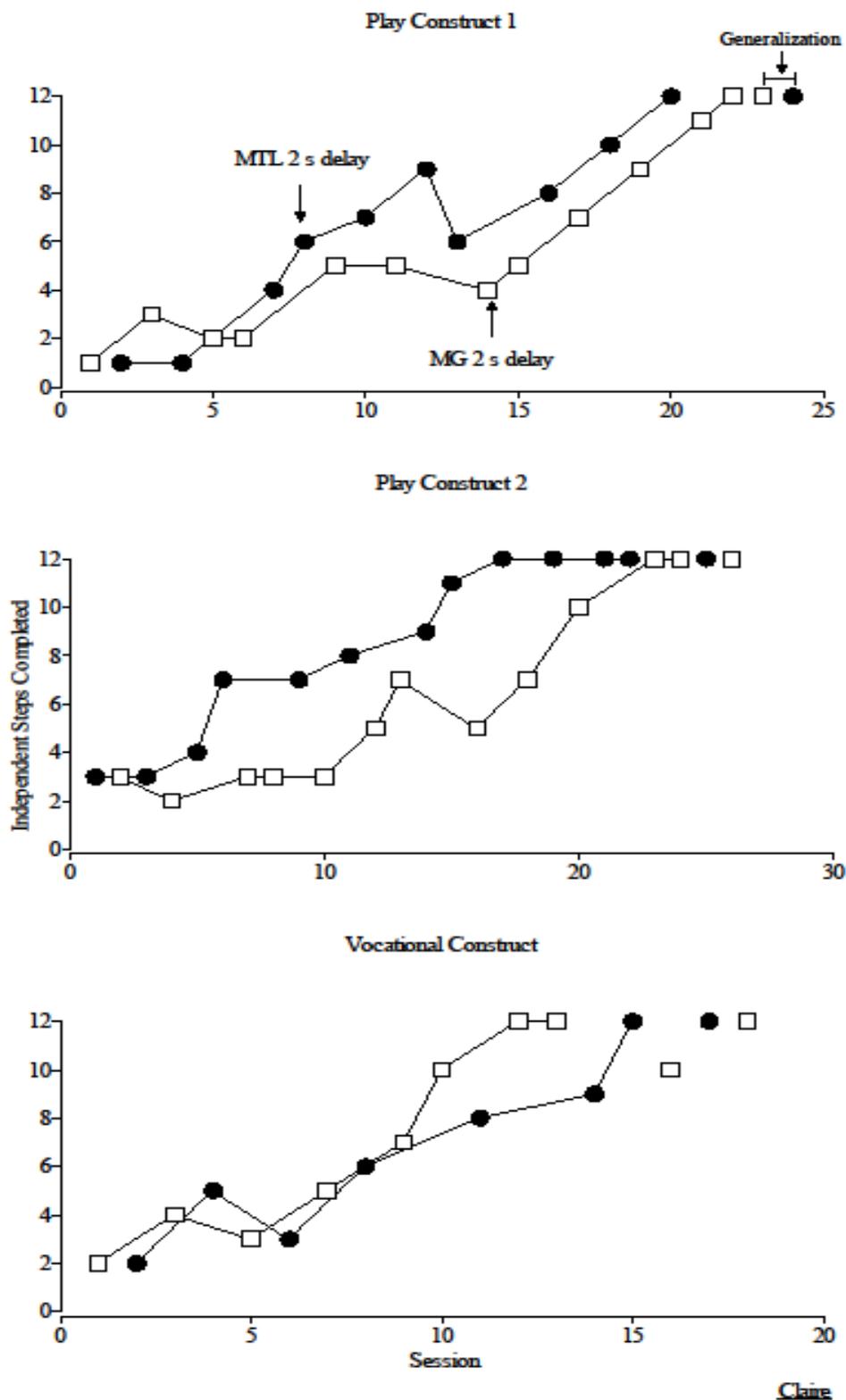
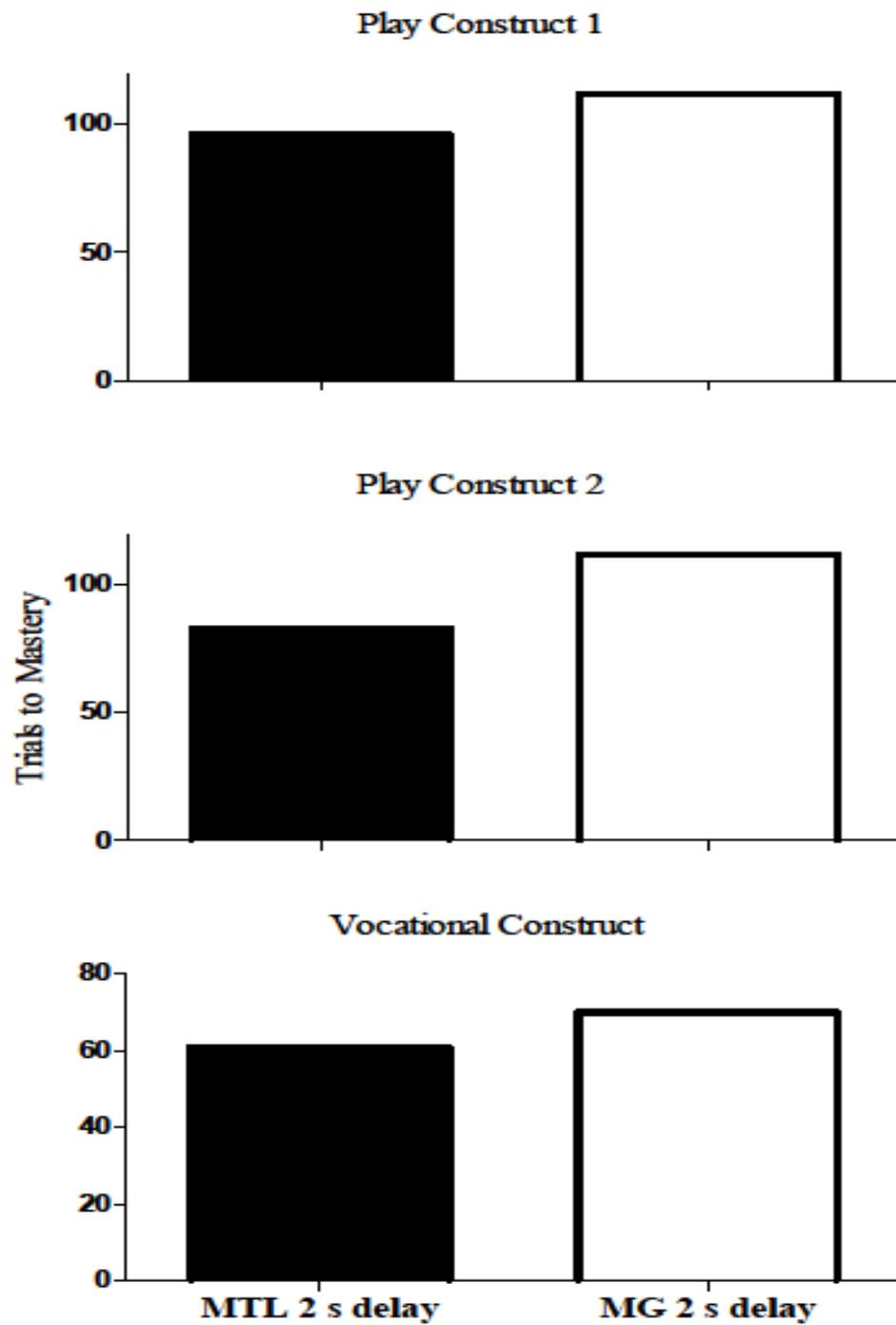


Figure 7: Independent steps completed for both play tasks and the vocational task for Claire.



Claire

Figure 8: Trials to mastery for all tasks for participant Claire.

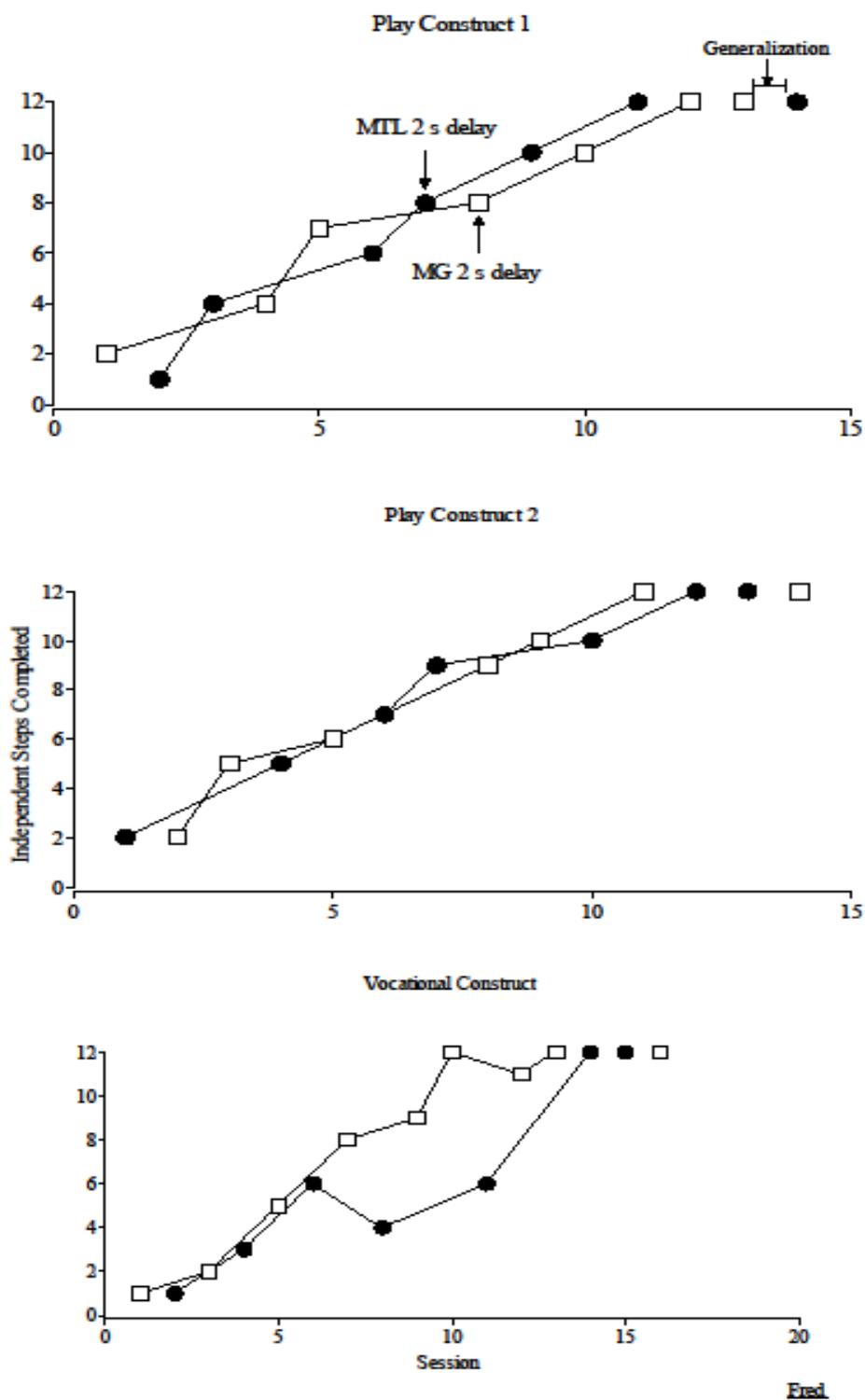
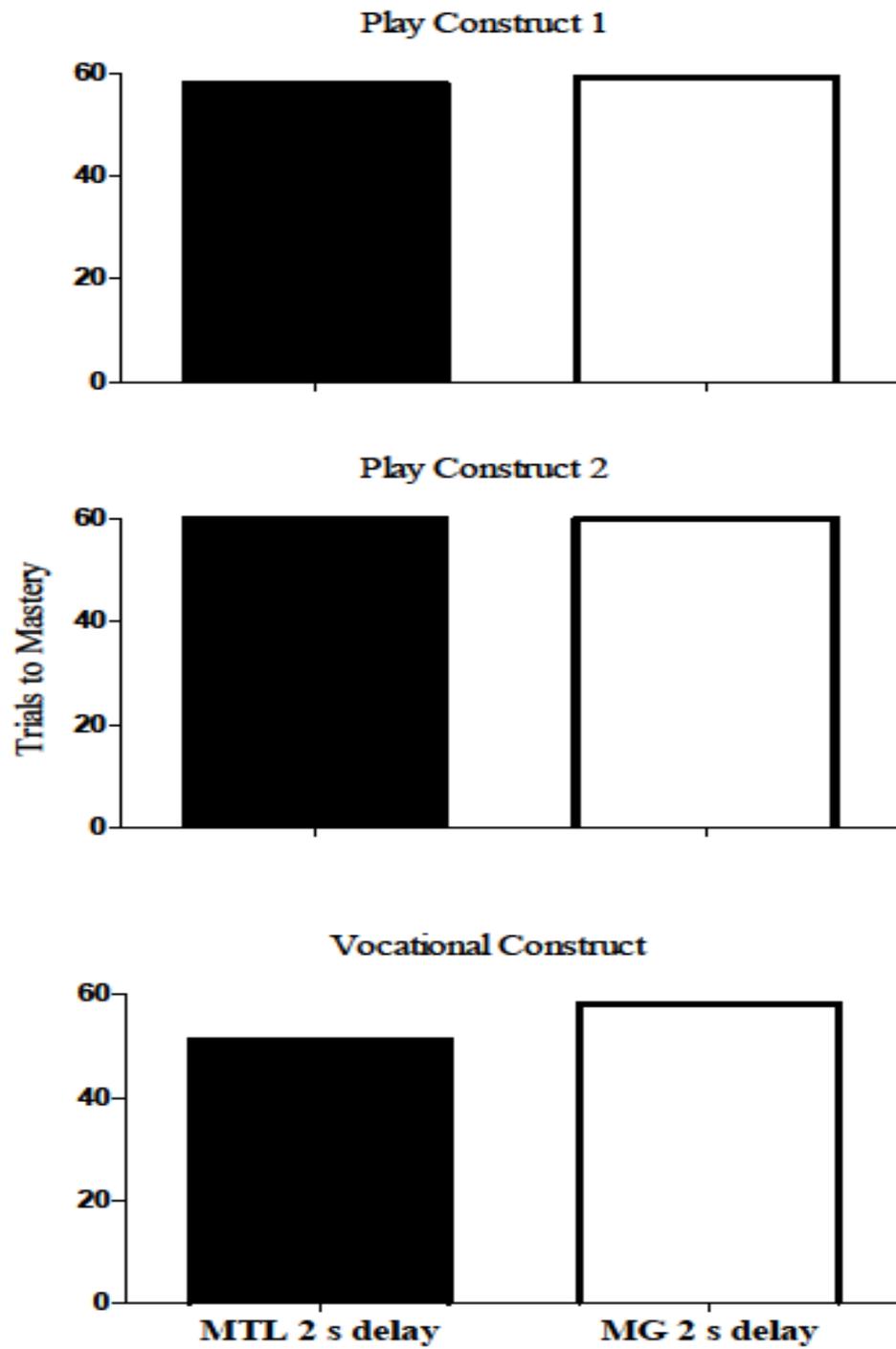


Figure 9: Independent steps completed for both play tasks and the vocational task for Fred.



Fred

Figure 10: Trials to mastery for all tasks for participant Fred.