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Assessing Discrimination Skills of Individuals With Developmental and Physical Disabilities Using Microswitches

Évaluation des habiletés de discrimination des personnes ayant un trouble du développement et un handicap physique à l'aide de microrupteurs

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Abstract

The Assessment of Basic Learning Abilities (ABLA) measures the ability of a person with developmental disabilities to learn basic discrimination tasks. Its ease of use and strong psychometric properties make the ABLA a valuable tool for research and training. However, the ABLA requires a person to respond on each trial by grasping and placing an object into a container, which may not be possible for persons with limited hand function or arm movements. We modified the procedure by replacing the original response with switch-pressing to assess individuals who were not testable previously due to physical difficulties. Three females with developmental and physical disabilities participated. In Phase 1, all three participants demonstrated that their switch-pressing response was sensitive to positive reinforcement in an ABAB design. In Phase 2, baseline assessments showed that participants were unable to perform the ABLA 2-choice discrimination tasks. Switch pressing was introduced in a multiple-baseline design across four tasks and participants responded consistently on nearly all trials. Moreover, all participants performed the visual-position discrimination task at high accuracy using the switch-pressing response.

Résumé

L'Évaluation des habiletés d'apprentissage de base (en anglais : Assessment of Basic Learning Abilities, ABLA) est un outil qui mesure l'habileté d'une personne ayant un trouble du développement à apprendre des tâches de discrimination de base. Sa facilité d'utilisation et ses excellentes propriétés psychométriques font de l'ABLA un outil d'intérêt pour la recherche et la formation. Toutefois, l'ABLA nécessite qu'une personne réponde à chacun des essais en saisissant un objet et en le plaçant dans un contenant, ce qui peut ne pas être possible pour les personnes dont la fonction de la main ou les mouvements des bras sont limités. Dans la présente étude, cette procédure a été modifiée en remplaçant la réponse usuelle par l'appui sur un microrupteur afin d'évaluer les personnes qui ne pouvaient être testées autrement en raison de difficultés physiques. Trois femmes ayant une déficience intellectuelle et physique ont participé à cette étude. Lors de la phase 1, les trois participantes ont démontré que leur réponse d'appui sur le microrupteur était sensible au renforcement positif dans un devis ABAB. Lors de la phase 2, les mesures du niveau de base ont montré que les participantes ne pouvaient pas effectuer les tâches de discrimination à deux choix du ABLA. La réponse d'appui sur le microrupteur a été introduite dans un devis à niveaux de base multiples pour quatre tâches. Les participantes ont répondu de manière constante à presque tous les essais. De plus, toutes les participantes ont effectué avec grande précision la tâche de discrimination visuospatiale en utilisant la réponse d'appui sur un microrupteur.

Mots clés : Paralysie cérébrale, évaluation des habiletés de discrimination, microrupteurs, polyhandicap, quadriparésie spastique

Introduction

The *Assessment of Basic Learning Abilities* (ABLA; Kerr, Meyerson, & Flora, 1977) directly measures the ability of persons with developmental disabilities to learn to perform basic visual and auditory discriminations. The ABLA has strong psychometric properties and is a practical instrument for rehabilitation workers and teachers to select appropriate training activities and for researchers to determine the existing discrimination repertoires for such individuals (Martin & Yu, 2000). However, despite the demonstrated usefulness of the ABLA, there remains a portion of individuals with developmental disabilities and physical challenges whose discrimination skills cannot be measured because the procedure requires a testee to respond on each trial by grasping and placing a small object (a piece of foam) into a container. This is unfortunate, as it is important to have reliable and objective measures of basic discrimination skills for these individuals to help set appropriate objectives and design effective interventions. The purpose of this study was to evaluate a modified ABLA procedure to assess these individuals.

The ABLA is a criterion-referenced assessment tool which directly measures the ease or difficulty with which a client can learn to reliably perform a simple imitation and five two-choice discriminations (Kerr et al., 1977). The six tasks are also referred to as levels. Level 1 is an imitation task that involves asking the testee to put a piece of white foam into a container after having observed the tester perform the behaviour on each trial. Although called "imitation", the task serves as a warm-up to familiarize the testee with the materials. Level 2 is a two-choice

visual-position discrimination that involves asking the testee to put a piece of white foam into a yellow can on the left, when presented with both a yellow can and a red box in fixed left-right positions. Level 3 is a two-choice visual discrimination that requires the testee to put a piece of white foam into a yellow can when the right-left positions of the yellow can and red box are randomly alternated across trials. Level 4 is a two-choice visual-visual conditional discrimination that involves asking the testee to put a small red cube in the red box and a small yellow cylinder in the yellow can, when presented with either the cylinder or the cube on each trial, and the right-left positions of the yellow can and red box are randomly alternated across trials. Level 5 was an auditory discrimination when the ABLA was developed (Kerr et al., 1977). However, research has shown that since most individuals who could perform Level 5 could also perform Level 6, it was recommended that Level 5 be omitted from the ABLA (Martin & Yu, 2000). Therefore, the ABLA has been revised and Level 5 has been replaced with a two-choice visual-visual non-identity conditional discrimination (ABLA-R, DeWiele, Martin, Martin, Yu, & Thomson, 2011). This discrimination is similar to Level 4 except that instead of the yellow cylinder and red cube the manipulanda are the words "BOX" (made of a silver foam block) and "Can" (made of a purple foam block). Level 6 is a two-choice auditory-visual conditional discrimination that involves asking the testee to put a piece of white foam in either the yellow can or red box, presented in randomized positions across trials, when the experimenter randomly says either "yellow can" (in a slow, low-pitched manner) or "red box" (in a quick, high-pitched manner). A summary of the visual and auditory cues presented for each task is shown in Table 1. Each task is tested individually at a table, with the testee seated directly across from the examiner. A "pass" is assigned to a task if the testee performs it correctly on eight consecutive trials and a "fail" is assigned to a task if the participant performs incorrectly on eight total trials, whichever occurs first.

Research has shown that the ABLA levels are hierarchical in difficulty from Level 1 through Level 6 with children and adults with developmental disabilities (Kerr et al., 1977; Martin, Yu, Quinn, & Patterson, 1983), individuals with developmental disabilities and hearing impairments (Kerr & Meyerson, 1977; Wacker, 1981), children with pervasive developmental disorders (Ward & Yu, 2000), and with typically developing children (Casey & Kerr, 1977). Research has also shown that the ABLA possesses high test-retest reliability and inter-tester reliability (Martin et al., 1983). Research findings indicate that ABLA performance is predictive of learning for individuals with developmental disabilities on language and adaptive behaviours (Martin, Thorsteinsson, Yu, Martin, & Vause, 2008; Martin & Yu, 2000; Viel et al., 2011; Vause, Yu, & Martin, 2007), types of prompting (e.g., visual versus auditory) needed for compliance with individuals with developmental disabilities (LaForce & Feldman, 2000), and stimulus modalities (visual versus auditory) during preference assessments (Conyers et al., 2002; de Vries et al., 2005; Reyer & Sturmey, 2006). Although the ABLA has been shown to be effective for assessing discrimination abilities with many individuals with severe and profound developmental disabilities, the required response of placing a manipulandum (foam, cube, or cylinder) into a container may preclude its use with individuals with limited hand function or arm movements.

For persons with multiple disabilities (developmental or intellectual disabilities accompanied by physical disabilities), various microswitches have been successfully used to increase their interaction and engagement with their environment, indicate preference, and make requests (Lancioni, O'Reilly, & Basili, 2001; Lancioni et al., 2008; Wacker, Berg, Wiggins, Muldoon, & Cavanaugh, 1985; Wacker, Wiggins, Fowler, & Berg, 1988). Microswitches may also be useful in assessing discrimination skills of persons with multiple disabilities. The purpose of this study

was to evaluate the effectiveness of a modified ABLA assessment procedure, in which the standard response was replaced with a switch-pressing response, for individuals with intellectual and physical disabilities. The study included two phases. In Phase 1, we ensured that the participants were capable of pressing the microswitches and evaluated whether switch pressing was sensitive to positive reinforcement. In Phase 2, the effectiveness of using microswitches to administer the ABLA was evaluated. The study received ethical approval from the institutional research ethics board before it began.

Table 1 - *Visual and Auditory Cues Presented at Each Level of the ABLA-R*

Tasks or Levels	Containers on each Trial	Manipulandum on each Trial	Cues from Tester	Correct Response [a]	Incorrect Response
1. Imitation [b]	1, box or can	1, cube, cylinder, or white foam	Demonstrates the correct response on every trial, and say "Put it in" [c]	Put manipulandum in container	Put manipulandum anywhere outside container
2. Position [d]	2, box and can, position *stable* across trails	1, white foam	"Where does it go?"	Put foam in can on the right	Put foam in box on the left
3. Visual	2, box and can, position *randomized* across trials	1, white foam	"Where does it go?"	Put foam in can regardless of position	Put foam in box regardless of position
4. Matching-to-sample (Visual-visual quasi-identity)	Same as Level 3	1, cube or cylinder, randomized across trails	"Where does it go?"	Put cube in box or cylinder in the can	Put cube in can or cylinder in box
5. Visual-visual nonidentity [e]	Same as Level 3	1, BOX or Can foam block, randomized across trials	"Where does it go?"	Put BOX foam block in box or Can foam block in can	Put BOX foam block in can or Can foam block in box
6. Auditory-visual	Same as Level 3	1, white foam	"*y-e-l-l-o-w c-a-n*" (spoken slowly and in a low pitch) or "*red box*" (spoken quickly and in a high pitch)	Put foam in the requested container	Put foam in the non-requested container

[a] Correct response is reinforced. Incorrect response is followed by an error correction procedure. [b] Despite its name, this is a warm-up task. [c] Except for the auditory-visual task (Level 6), the vocal cue is not "instructional" and serves simply to prompt the testee to initiate responding. [d] Despite its name, this is a *visual* discrimination in which position is one of the relevant cues. [e] The auditory discrimination in the original ABLA has been replaced with the visual-visual nonidentity conditional discrimination in the ABLA-R.

This table has been reprinted with permission from Yu, Martin, Vause, and Martin (2015).

Method

Participants and Settings

Three females were recruited from a community agency serving individuals with developmental disabilities. Written informed consent was obtained from the legal guardian for all participants before the study began. Participant 1 was 17 years old and diagnosed with cerebral palsy with spastic quadriparesis and developmental delay. Participant 2 was 34 years old and diagnosed with severe developmental delay, spastic quadriparesis, and scoliosis. Participant 3 was 25 years old and diagnosed with developmental delay and spastic quadriparesis. All participants were nonverbal and not ambulant. Participant 1 could not grasp or hold an object (as her hands were always clenched), but she was able to move her hand side to side on a tabletop. Participant 2 had difficulty grasping and holding an object, but she was able to lift and extend her right arm. Participant 3 could not grasp and hold an object (as her hands were also always clenched), but she was able to lift and extend both of her arms. All participants were screened with the standard ABLA before the study and all three were unable to emit the response required by the ABLA.

Sessions were conducted individually in either an assessment room or a quiet area in the participants' residence or classroom. A participant sat in her wheelchair, which was equipped with a tray and the experimenter sat facing the participant in all sessions. During some sessions, an observer was present to conduct reliability checks, while other sessions were videotaped.

Phase 1: Evaluation of Reinforcement Control for Switch-Pressing Response

Materials, response definition, and design. A round microswitch (6 cm in diameter), model One-Step Communicator 20® by AbleNet Inc., was used. A switch press was defined as the participant depressing the microswitch, which required 2-3 g of force and produced an audible "click". A stopwatch was used to time sessions and preferred items were used to consequate switch presses. Preferred items were nominated by each participant's direct care staff and the most preferred item for each participant was used as the reinforcer for switch pressing. The items were a plasma ball (a 33-cm diameter sphere that glowed with random, moving streams of light) for Participant 1; a massager for Participant 2; and a disco ball (a 20-cm rotating sphere with flashing lights) for Participant 3. An ABAB reversal design was used to evaluate whether switch-pressing was sensitive to reinforcement for each participant. During baseline condition (A), each switch-press was followed by a brief praise statement. During reinforcement condition (B), switch-pressing was followed by praise plus brief access to the preferred item. The procedures for each condition are described below.

Baseline condition. One practice trial was carried out at the beginning of each session to ensure that the participant had contacted the consequence for switch pressing. During the practice trial, the experimenter placed a single microswitch within reach and in front of the participant, without providing any verbal instruction or modeling. If the participant pressed the switch within 5 s of the switch presentation, a brief praise statement was immediately provided by the experimenter (e.g., "good job"). If the participant had not pressed the switch after 5 s, the experimenter provided a verbal instruction ("<Name>, press the switch"). If the participant again did not press the switch after 5 s, the experimenter gently guided the participant to complete the response and

then provided praise.

Following the practice trial, the experimenter began the session by presenting the switch in front of the participant, giving the initial instruction once (i.e., "<Name>, press the switch"), and starting the session timer. When the participant pressed the switch, the experimenter paused the timer, removed the microswitch and gave a brief praise statement, recorded the response on the data sheet, re-presented the microswitch (without any verbal instructions), and restarted the timer. The session continued until the timer had accumulated 3 minutes. The participant was given a 5-minute break between sessions to socialize with the experimenter and to engage in some tabletop leisure activities.

Participants 2 and 3 received praise for switch-pressing on an FR 1 schedule (fixed-ratio schedule in which reinforcement is given after each response). Due to her high response rate, Participant 1 received praise on an FR 3 schedule (reinforcement given after every three responses). The number of responses per minute was computed for each session as the dependent measure. Baseline sessions were conducted until the response rate was considered stable based on visual inspection.

Reinforcement condition. Procedures for the reinforcement sessions were the same as those described for the baseline sessions in all respects, except for the following. During the practice trial at the beginning of a session and on all trials during the session, the preferred item was also provided whenever praise was delivered as a consequence. Participants could interact with the item for approximately 10 s before it was retrieved and the switch was re-presented.

Interobserver reliability and procedural integrity checks. An observer conducted live interobserver reliability and procedural integrity checks for all participants during both baseline and reinforcement conditions. The average percentage of sessions checked across participants was 57%, ranging from 50% to 60%.

During interobserver reliability checks, the observer recorded the number of switch presses during each session and the total number was compared to the experimenter's recording. Percent agreement per session was calculated by dividing the smaller number by the larger number, and then multiplying by 100% (Martin & Pear, 2019). The mean percent agreement per session across participants was 99.7%, ranging from 99.1% to 100%.

During procedural integrity checks, the observer recorded whether the experimenter followed the procedures correctly using a checklist, which included the following behaviours: (1) conducting the pre-session practice trial, (2) presenting the switch to the participant, (3) providing or not providing the verbal instruction, (4) removing the switch following each target response, and (5) providing the consequence following the target response appropriate to the condition and schedule. The percentage of correct responses based on available opportunities was calculated for each session (e.g., each session would have one opportunity to conduct the pre-session practice trial, and each switch-press during the session would be an opportunity for the other steps). The mean percentage of correct responses across observed sessions and participants was 100%.

Phase 2: Evaluation of Microswitches for Discrimination Assessment

Materials, response definitions, and design. Two round microswitches (6 cm in diameter), and

the red cube and yellow cylinder from the ABLA materials were used. The two switches were fastened to a piece of board approximately 12.5 cm apart, facing each other at a 90º angle. Yellow or red (with black stripes) colour discs were placed beneath the transparent plastic cover of each switch. The discs could be changed before each trial as needed. The apparatus is shown in Figure 1.

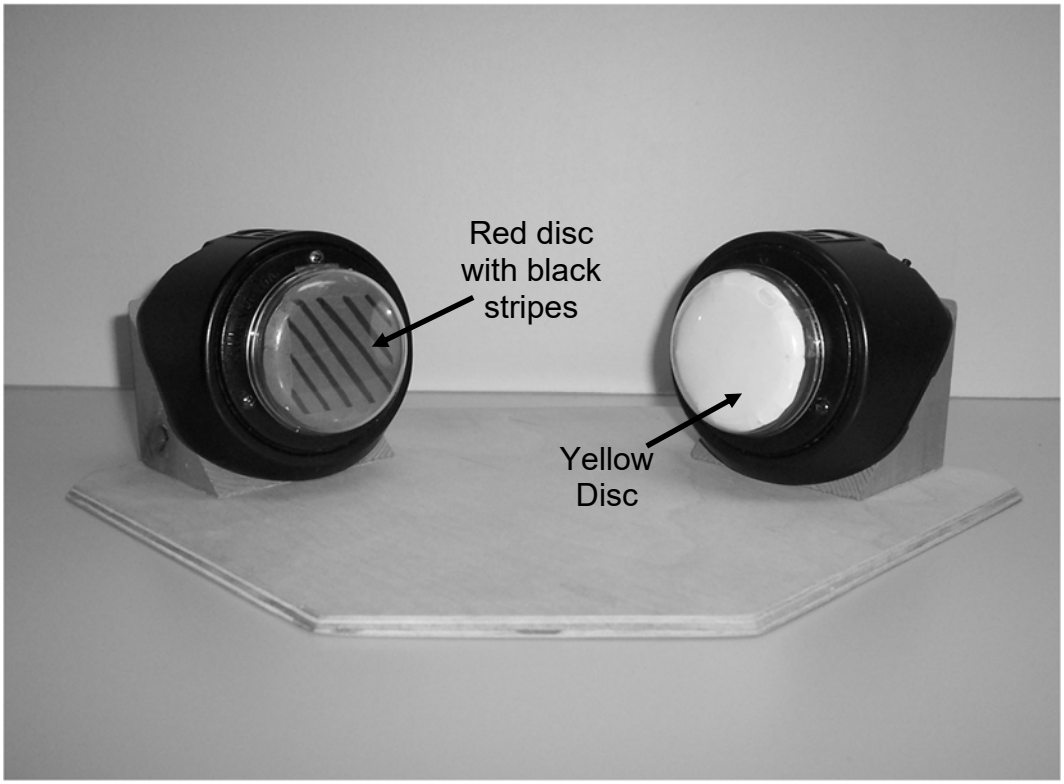

Figure 1. *Apparatus with two microswitches (AbleNet Inc., model One-Step Communicator 20®) mounted and facing each other at a 90º angle, viewed from the participant's perspective. The distance between the microswitches was 12.5 cm. The yellow and red with black stripes colour discs could be changed across trials as needed.*

A multiple-baseline design across four discrimination tasks was used for each participant (Martin & Pear, 2019). During baseline (ABLA condition), the standard ABLA response was used for the assessment. The intervention (Switch-Pressing condition) was introduced successively across tasks. After the intervention had been introduced for all tasks, reversals to baseline and intervention were conducted successively across tasks for each participant. The procedures for each condition are described below.

Baseline ABLA condition. We administered the ABLA test trials for each discrimination task as the baseline condition. Each session began with a demonstration and a physically guided trial, followed with praise, before presenting the test trials. For each ABLA level, the containers and manipulandum were presented as described in the introduction.

If the participant responded correctly on a test trial (i.e., placing the manipulandum into the correct container), praise and access to the preferred item for 10 s were provided immediately. If

the participant responded incorrectly (placing the manipulandum anywhere outside the correct container) or did not respond after 10 s, the experimenter conducted an error correction procedure which included a demonstration of the correct response, guiding the participant to complete the response, and provided an opportunity for the participant to perform the behaviour independently. A correct independent response was praised, but it was not counted towards the pass criterion; an incorrect response, however, was counted towards the fail criterion. The experimenter recorded the participant's response before presenting the next trial.

For the purpose of the study, we limited each session to 10 trials, instead of testing until either the ABLA pass or fail criterion was reached, because these participants tended to respond slowly and we wanted to limit the session duration. Ten trials per session also provided a consistent denominator for comparison across sessions.

Switch-pressing condition. During this condition, the procedures were the same as the ABLA condition in all respects, with the following exceptions. The ABLA containers were replaced with microswitches (see Figure 1). At the beginning of a trial, the apparatus was placed on a participant's wheelchair tray and the participant's hand was placed halfway between the two switches. A switch-press was defined as the participant depressing the microswitch (by moving her hand only a short distance left or right or by rolling her wrist left or right). When the microswitches were used, the verbal prompt "Where does it go?" was changed to, "Which one?" for Levels 2, 3, and 4. In addition, for Level 4, quasi-identity visual-visual conditional discrimination was assessed by holding up as the sample either the red cube with black stripes or small yellow cylinder and asking "Which one?" Finally, on Level 6, the verbal prompts, "y-e-l-l-o-w…c-a-n" and "REDBOX" were changed to "y-e-l-l-o-w…button" and "REDBUTTON".

Interobserver reliability and procedural integrity checks. An observer conducted interobserver reliability and procedural integrity checks for all participants during both ABLA and switch-pressing conditions, and the mean percentage of sessions observed was 48% across participants, ranging from 39% to 55%. Checks were done primarily live, with a small fraction done by viewing videotapes of the sessions at a later time.

During live interobserver reliability checks, the experimenter and an observer independently recorded the participant's response on each trial. A trial was scored as an agreement if both the experimenter and the observer recorded the same response and it was scored as a disagreement if the recordings differed. For videotaped sessions, the observer recorded the participant's response from the videotape and compared the recordings to the experimenter's data taken during the session. Percentage agreement per session was calculated by dividing the number of agreements by the sum of agreements and disagreements, and multiplying by 100% (Martin & Pear, 2019). The mean percent agreement per session across participants was 99.6%, with a range of 98.8% to 100%.

The observer also conducted procedural integrity checks using a pre-defined behaviour checklist. The checklist included the following behaviours that should be emitted by the experimenter conducting the demonstration sequence and each test trial: (1) presenting the containers in the correct positions or the appropriate colour discs for the correct microswitches, (2) conducting the demonstration correctly, (3) conducting the guided trial correctly, (4) providing the correct verbal prompt, (5) providing an opportunity for an independent response, and (6) providing the appropriate consequence following a response. A trial was scored as correctly delivered if the experimenter followed all the steps correctly; otherwise, the trial was scored as an error. The

mean percentage of trials per session carried out correctly by the experimenter was 98.8% across participants, ranging from 96.3% to 100%.

Results

Phase 1: Evaluation of Reinforcement Control for Switch-Pressing Response

Figure 2 shows the number of switch presses per minute during baseline and reinforcement conditions for each participant.

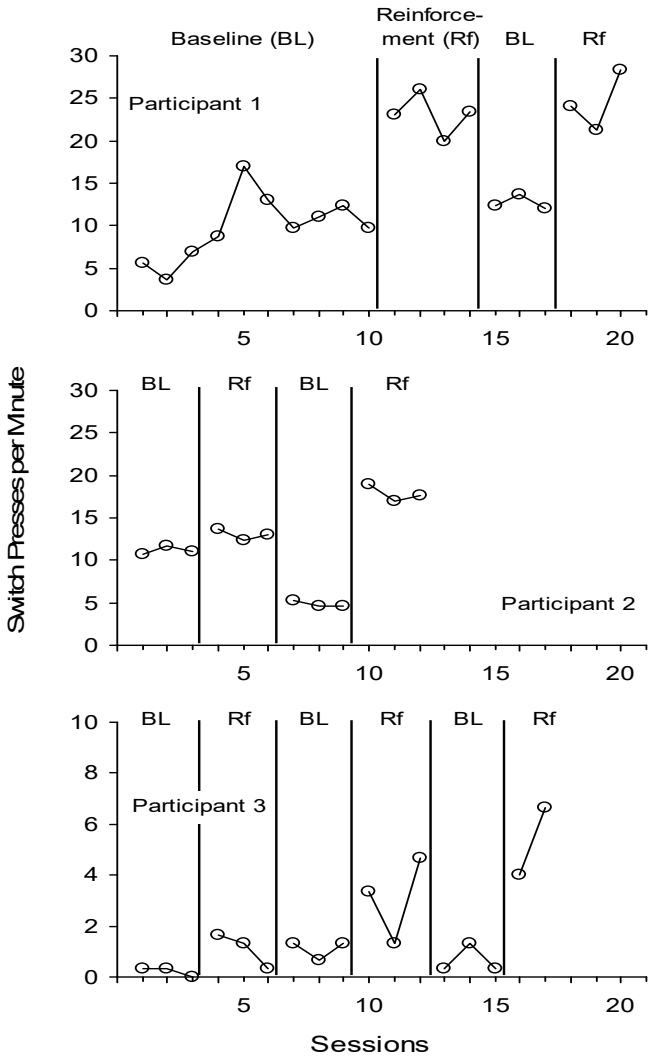

Figure 2. *Switch-presses per minute during baseline (praise only) and reinforcement (praise plus 10 s access to an item) conditions for each participant. Items presented during reinforcement for Participants 1 through 3 were plasma ball, massager, and disco ball, respectively.*

Participant 1's rate of responding stabilized near 10 per minute towards the end of the first baseline phase (top graph). Rate of responding approximately doubled during the first reinforcement condition relative to the first baseline phase. During the second baseline, switch pressing decreased to a level similar to the terminal response rate of the first baseline phase. During the second reinforcement phase, switch pressing increased to a level similar to the first reinforcement phase. Except for the first five to six baseline sessions during the first phase, the response rate was relatively stable in each condition. Changes between phases were immediate and large, with no overlapping data points between baseline and reinforcement conditions.

Participant 2's results are shown in the middle graph of Figure 2. Her response rate was only slightly higher during the first reinforcement phase relative to the first baseline condition. However, response rate decreased substantially during the second baseline and increased substantially during the last reinforcement phase. This suggested that the massager was not a weak reinforcer and that Participant 2 might have needed more time to come under the control of the reinforcement contingency. The response rate was relatively stable in each condition, response changes between baseline and reinforcement conditions were small initially but increased during the reversals.

Participant 3's results are shown in the bottom graph of Figure 2. Her response rate was only slightly higher during the first reinforcement phase (and it declined across sessions) relative to the first baseline phase. Switch pressing during the second baseline phase was similar to the first reinforcement phase. At this point, her results suggested that either the switch-pressing response was not sensitive to the reinforcement contingency or that the disco ball did not add any reinforcing value beyond praise. However, a slightly larger effect was observed during the second reinforcement phase. Following a reversal to baseline condition, response rate increased further during the third reinforcement phase relative to the previous reinforcement condition.

In summary, a strong reinforcement effect on switch pressing was observed for Participant 1. For Participants 2 and 3, a reinforcement effect was not observed initially, but a clear reinforcement effect emerged after additional alternations between baseline and reinforcement phases. Overall, the results showed that switch pressing increased as a result of reinforcement for each participant.

Phase 2: Evaluation of Microswitches for Discrimination Assessment

Figure 3 shows the results of discrimination assessments using the standard ABLA response and the switch-pressing response for Participant 1.

Triangles in the figure represent the number of trials for which the participant emitted a response regardless of accuracy and squares represent the number of correct trials in each session. For the ABLA Level 2 task (top graph), Participant 1 did not respond on any of the 10 trials during the first baseline session when the standard ABLA response was used. However, after the microswitches were introduced, Participant 1 responded on all 10 trials (triangles), with accuracy of 100%, 90%, and 100% across three sessions (squares).

For the ABLA Level 3 task (second graph in Figure 3), Participant 1 did not respond on any trials during the first baseline session and the same lack of responding was observed in the second baseline session conducted after the microswitches had been introduced for the Level 2 task. However, when discrimination assessment was conducted using the microswitches,

Participant 1 responded on all 10 trials (triangles), with accuracy (squares) of 50%, 70%, and 50% across three sessions.

For

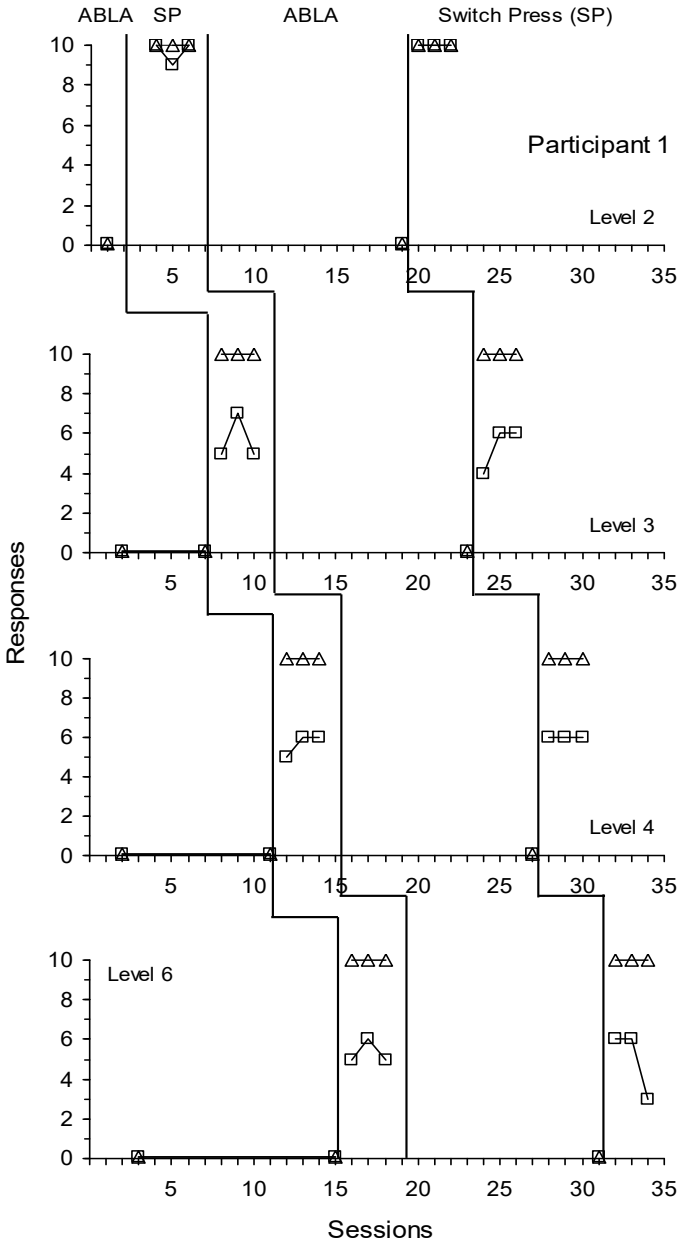

Figure 3. *Number of responses (triangles) and number of correct responses (squares) during standard response requirement (ABLA) and switch-press (SP) conditions for Participant 1.*

Levels 4 and 6 (bottom two graphs), the patterns of responding during ABLA and the microswitch phases were similar to Level 3. That is, Participant 1 did not respond during baseline ABLA sessions, but responded on all trials for Levels 4 and 6 when the microswitches were used. However, her response accuracy was near chance (50%) for both levels.

After the intervention had been completed for all four levels in the multiple baseline design,

reversals to baseline (ABLA) and intervention (switch pressing) were implemented for each level also in a multiple baseline design (Figure 3). The response patterns and accuracy observed in each condition and for each level during the reversals were similar to those observed during the previous baseline and intervention conditions, respectively.

Figure 4 shows the results of discrimination assessments using the standard ABLA response and the switch-pressing response for Participant 2.

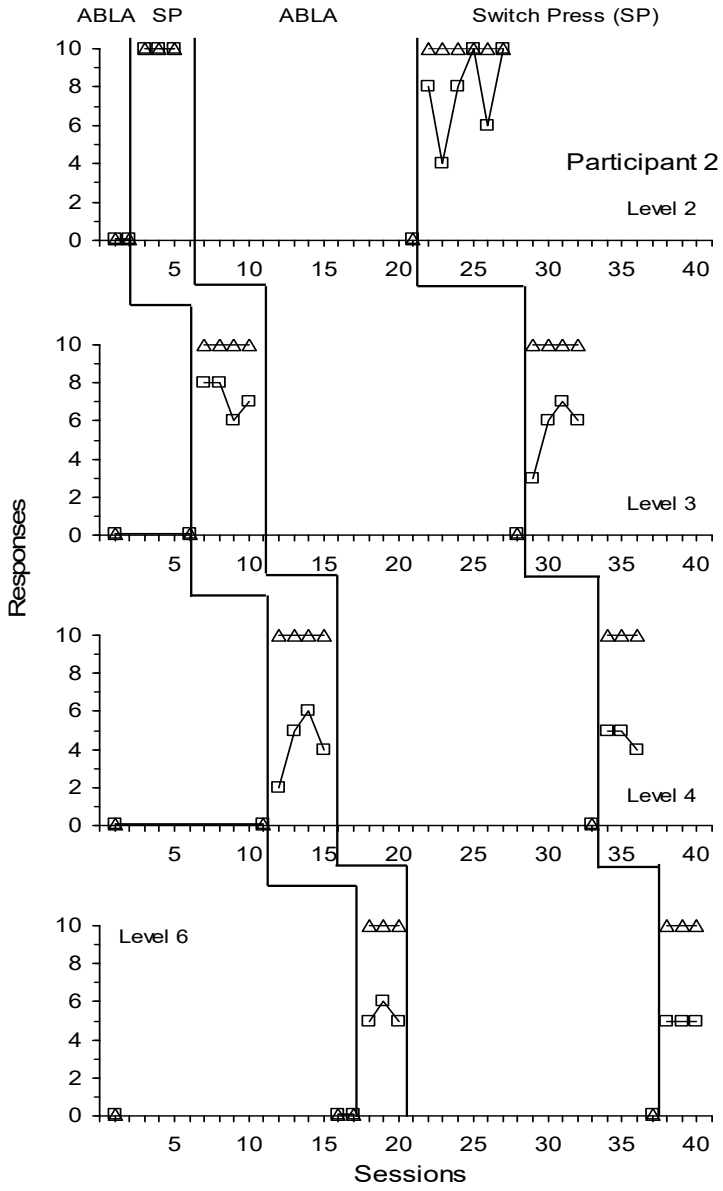

Figure 4. *Number of responses (triangles) and number of correct responses (squares) during standard response requirement (ABLA) and switch-press (SP) conditions for Participant 2*

For the ABLA Level 2 task (top graph), Participant 2 did not respond on any of the 10 trials during the first two baseline sessions when the standard ABLA response was used. However, after the switch-press response was introduced, Participant 2 responded on all 10 trials (triangles), with accuracy of 100% across all three sessions (squares).

For the ABLA Level 3 task (second graph in Figure 4), Participant 2 did not respond on any trials during the first baseline session and the same lack of responding was observed in the second baseline session conducted after the first switch-pressing phase had been introduced for Level 2. However, when discrimination assessment was conducted using microswitches, Participant 2 responded on all 10 trials (triangles), with accuracy (squares) of 80%, 80%, 60%, and 70% across the four sessions.

For Levels 4 and 6 (bottom two graphs), the patterns of responding during baseline ABLA and the switch-pressing phases were similar to Level 3. That is, Participant 2 did not respond during baseline ABLA sessions, but responded on all trials for Levels 4 and 6 when the microswitches were used. However, her response accuracy per session on Levels 4 and 6 were near chance (50%).

After the intervention had been evaluated across the four tasks in the multiple baseline design, reversals to baseline and intervention conditions were implemented for each task also in a multiple baseline design. With the exception of Level 2, in which accuracy of responding was more variable, the response patterns and accuracy observed in each condition and for each task during the reversals were similar to those observed during the previous baseline and intervention conditions, respectively.

Figure 5 shows the results of discrimination assessments using the standard ABLA response and the switch-pressing response for Participant 3.

For the ABLA Level 2 task (top graph), Participant 3 did not respond on any of the 10 trials during the first baseline session when the standard ABLA response was used. However, after the microswitches were introduced, Participant 3 responded on all 10 trials (triangles), with accuracy (squares) of 90%, 100%, and 100% across three sessions.

For the ABLA Level 3 task (second graph in Figure 5), Participant 3 did not respond on any trials during the first baseline session and the same lack of responding was observed in the second baseline session conducted after the first switch-pressing phase had been introduced for Level 2. However, when discrimination assessment was conducted using microswitches, Participant 3 responded on all 10 trials (triangles), with accuracy of 60% across all three sessions (squares).

For Levels 4 and 6 (bottom two graphs), the patterns of responding during baseline ABLA and the switch-pressing phases were similar to Level 3, except with slightly more variability in the number and accuracy of her responses. That is, Participant 3 did not respond during the baseline phase when the ABLA response was required, but responded on the majority of trials for Level 4 (ranging from 70% to 90%) and Level 6 (ranging from 90% to 100%) when the microswitches were used. However, her response accuracy per session was near chance level (50%) on both Levels 4 and 6, with the exception of one session on Level 6 with an accuracy of 80%.

After the intervention had been evaluated across the four tasks in the multiple baseline design, reversals to baseline and intervention conditions were implemented for each task also in a multiple baseline design. The response patterns and accuracy observed in each condition and for

each task during the reversals were similar to those observed during the previous baseline and intervention conditions, respectively.

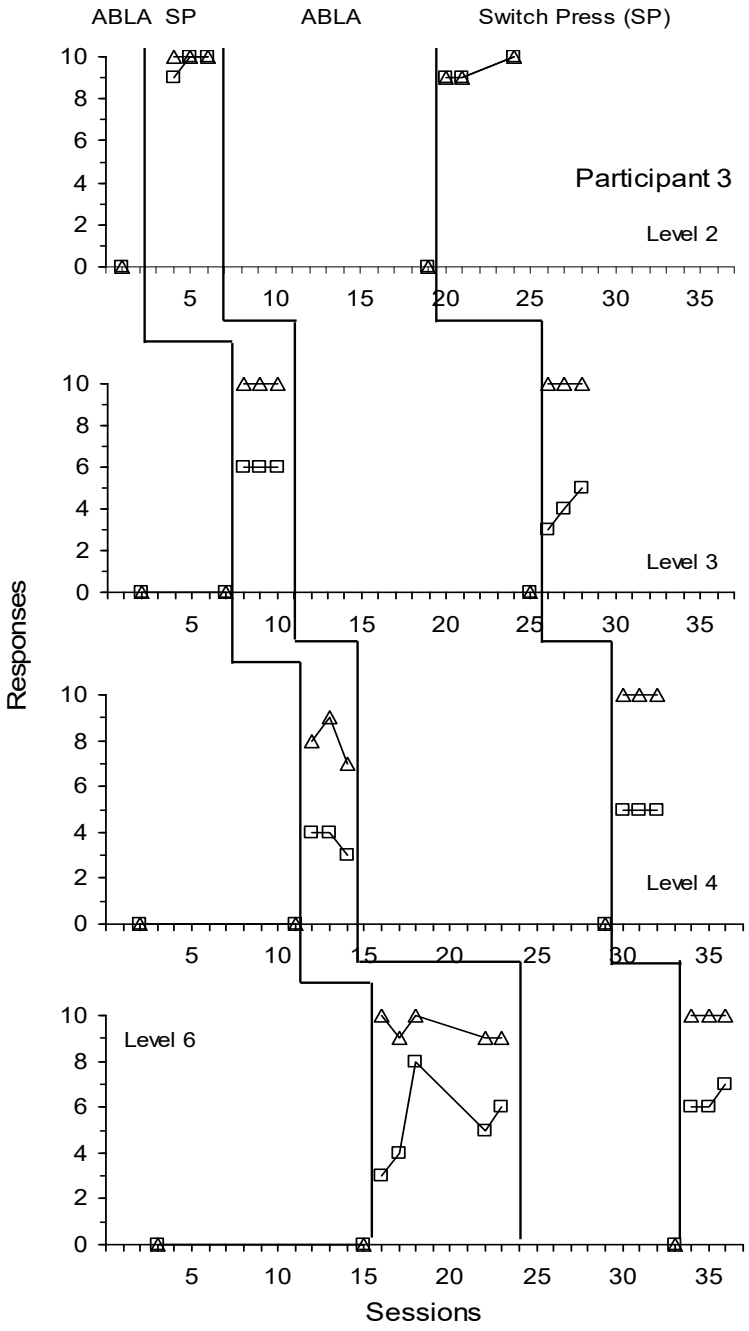

Figure 5. *Number of responses (triangles) and number of correct responses (squares) during standard response requirement (ABLA) and switch-press (SP) conditions for Participant 3.*

Discussion

During Phase 1, all participants were able to press the switch and their responses were sensitive to positive reinforcement. During Phase 2, while the ABLA standard response requirement produced no responding from the participants, the microswitches yielded a high level of responding for all participants and across all tasks. In addition, all three participants performed the ABLA Level 2 task with high accuracy on multiple sessions – Participant 1 responded correctly on at least nine consecutive trials (out of 10 trials) across all six sessions; Participant 2 responded correctly on 10 consecutive trials (out of 10 trials) during five of the nine sessions; and Participant 3 responded correctly on eight consecutive trials (out of 10 trials) during five of the six sessions. Therefore, all participants clearly met the pass criterion of the standard ABLA assessment. Moreover, replications of the results during reversals provided strong support that their Level 2 task performance was reliable and that it could be attributed to the use of microswitches.

Although all participants also responded at a high rate for Levels 3, 4, and 6, none of the participants were able to obtain eight consecutive correct responses. For Level 3, Participant 1's best performance in a session was five consecutive correct responses, Participant 2's best performance was six consecutive correct responses, and Participant 3's was three consecutive correct responses. For Levels 4 and 6, all three participants' best performance in a session was four consecutive correct responses. The fact that these results were also replicated during reversals within each level gave us confidence about their reliability.

Although the results support the use of microswitches for assessing discrimination skills of persons with multiple disabilities, several potential limitations of the study should be noted. First, stability of behaviour is an important consideration for evaluating experimental effects in a single-subject design (Johnston & Pennypacker, 1980). During Phase 2 of the study, it could be argued that stability had not been established during the baseline phases in which the ABLA response was required because only one to two data points were collected during each baseline phase. However, since all participants had previously demonstrated that they were not testable during the initial ABLA screening assessment, it was reasonable to assume that the lack of responding was unlikely to change simply with repeated exposure. When there is an a priori assumption of stability, Horner and Baer (1978) have suggested that data sampling frequency could be reduced to intermittent probes. In addition, the response pattern (absence of responding) was remarkably consistent across baseline phases within each task, across tasks, and across participants, which would suggest that the participants' baseline performance was indeed stable.

Another potential limitation of the study is that all participants passed Level 2 but did not pass subsequent levels. It could be argued that this outcome is not a reflection of discrimination ability, but rather it could be achieved by always responding to one side, which is not an uncommon problem in persons with developmental disabilities during discrimination training. Although participants could have achieved this outcome by perseverating to one side, this was not the case in the present data. Correct responses were observed for both left and right positions at all levels above Level 2. In addition, accuracy as high as 80% (although not eight consecutive correct) was observed in two sessions at Level 3 for Participant 2, and in one session at Level 6 for Participant 3. The finding that all three participants in the present study passed only Level 2

could have been a coincidence. Nevertheless, future research with participants at different discrimination levels will strengthen the current findings.

Another possibility for the chance performance accuracy above Level 2 could be due to the fact that the switch pressing response was no longer reliable or sensitive to reinforcement. Although this was unlikely given that it occurred for all three participants at different times during the study, future research should conduct a reversal to Phase 1 following the ABLA assessment to verify that the switch pressing response was still reliable for the participant.

Another potential limitation of this study is that the participants were not tested using the ABLA pass/fail criterion (i.e., testing until either eight consecutive correct responses or eight cumulative errors whichever comes first) using the microswitches. Although the participants had clearly met the ABLA pass criterion at Level 2, since they achieved eight consecutive correct responses within a 10-trial session several times, it is possible that the participants could have passed higher levels if the sessions had not been terminated after 10 trials. This should be investigated in future research.

The whole session method was used to compute interobserver agreement in Phase 1. Future research should consider using more rigorous methods such as using equipment to record responses automatically or using an interval recording method.

The results of this study extended research on using microswitches with individuals with multiple disabilities by using the microswitches for discrimination skills assessments. More importantly, adapting the assessment procedures to use microswitches, such as the one evaluated in this study, enabled us to clinically assess the participants' discrimination abilities for the very first time. Having reliable and objective measures of basic discrimination skills for these individuals is important if we are to set appropriate objectives and design effective interventions.

Key Messages from this Article

People with disabilities: You are able to do more if we find the right way for you to show us.

Professionals: The abilities of people with multiple disabilities may be limited by our procedures. We need to adapt and develop new ways to evaluate and learn about their skills.

Policymakers: People with multiple disabilities and severe challenges tend not to receive as much attention. Policy to promote applied research to develop practical procedures to improve our understanding of this group is much needed.

Messages clés de l'article

Personnes ayant une incapacité: Vous êtes capable de faire plus si nous trouvons la façon de vous permettre de nous le montrer.

Professionnels: Les habiletés des personnes qui ont un polyhandicap peuvent être limitées par les procédures utilisées pour les évaluer. Nous devons adapter et développer de nouvelles façons de les évaluer et d'en apprendre à leur sujet.

Décideurs : Les personnes qui ont un polyhandicap et d'importants défis à surmonter ont tendance à être laissés de côté. Une politique visant à promouvoir la recherche appliquée afin de développer des procédures pratiques pour améliorer notre compréhension de cette population est nécessaire.

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