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Predictive Validity of Auditory Discriminations in Persons with Intellectual Disabilities:

Extending the ABLA Test

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Abstract

It was hypothesized that performance on auditory-auditory identity matching (AAIM) and auditory-auditory nonidentity matching (AANM) prototype tasks would be predictive of performance on other matching tasks (generalization tasks) involving similar discriminations with adults with intellectual disabilities. Results indicated that: (a) 10 participants who failed the AAIM and AANM prototype tasks failed 93% of the generalization tasks; and (b) 8 participants who passed both AAIM and AANM tasks passed all generalization tasks. The potential of adding these tasks to the Assessment of Basic Learning Abilities (ABLA) (Kerr, Meyerson & Flora, 1977) test to improve its utility for people with intellectual disabilities is discussed.

Kerr, Meyerson and Flora (1977) developed the Assessment of Basic Learning Abilities (ABLA) test to assess the ease or difficulty with which persons with intellectual disabilities are able to learn six diagnostic tasks: Level 1, a simple imitation; Level 2, a two-choice position discrimination; Level 3, a two-choice visual discrimination; Level 4, a two-choice quasi-identity discrimination; and Levels 5 and 6, 2 two-choice auditory-visual discriminations (see Table 1). One or more of these discriminations are prerequisite for learning various self-care, vocational, and educational tasks (DeWiele & Martin, 1996).

Research indicates that the ABLA test is a valuable tool for teachers and rehabilitation workers for selecting and sequencing training and work tasks for persons with profound, severe, and moderate intellectual disabilities, and a useful screening tool for researchers in determining the ability level of participants prior to their exposure to various interventions (Martin & Yu, 2000). However, research also indicates that, if the full potential of the ABLA test is to be realized, it needs to be expanded beyond the six basic discriminations that were originally included. Specifically, preliminary research suggests that two auditory matching tasks may be worthwhile additions to the ABLA test (Harapiak, Martin & Yu, 1999; Marion et al., in press; Vause, Martin & Yu, 2000). The current study provides additional data in support of this possibility.

Table 1: A Description of the ABLA Levels and the Types of Discriminations Required

ABLA Level	*Types of Discriminations*
1. Imitation: A tester puts an object into a container and asks the client to do likewise.	A simple imitation.
2. Position Discrimination: When a red box and a yellow can are presented in a fixed position, a client is required to consistently place a piece of beige foam in the container on the left when the tester says, "Put it in."	A simultaneous visual discrimination with position, color, shape, and size as relevant visual cues.
3. Visual Discrimination: When a red box and a yellow can are randomly presented in left-right positions, a client is required to consistently place a piece of beige foam in the yellow can when the tester says, "Put it in."	A simultaneous visual discrimination with color, shape, and size as relevant visual cues.
4. Match-to-Sample Discrimination: A client demonstrates Level 4 if, when viewing a yellow can and a red box in randomly alternating left-right positions, and presented randomly with a yellow cylinder and a red cube, he/she consistently places a yellow cylinder in the yellow can and a red cube in the red box.	A conditional visual-visual identity discrimination with color, shape, and size as relevant visual cues.
5. Auditory Discrimination: When presented with a yellow can and a red box (in fixed position), a client is required to consistently place a piece of foam in the appropriate container when the tester randomly says, "red box" (in a high-pitched rapid fashion) or "yellow can" (in a low-pitched fashion).	A conditional auditory-visual nonidentity discrimination, with pitch, pronunciation, and duration as relevant auditory cues, and with position, color, shape, and size as relevant visual cues.

Table 1: (cont'd)

ABLA Level	*Types of Discriminations*
6. Auditory-Visual Discrimination: The same as Level 5, except that the right-left positions of the containers is randomly alternated.	A conditional auditory-visual nonidentity discrimination, with the same auditory cues as Level 5, and with only color, shape, and size as relevant visual cues.

When testing a student at a particular ABLA level such as Level 3, a visual quasi-identity discrimination, the student is given a demonstration, a guided trial, and an opportunity to respond independently. The student is then given a series of test trials at that level. Correct responses are praised, and incorrect responses are followed by a correction procedure. Training continues at a level until the student reaches a passing criterion of eight consecutive correct responses, or a failing criterion of eight cumulative errors.

Studies have indicated that ABLA Levels 5 and 6, the auditory discriminations, are correlated with measures of receptive and expressive communication (Barker-Collo, Jamieson & Boo, 1995; Casey & Kerr, 1977; Meyerson, 1977; Vause et al., 2000; Ward & Yu, 2000). This has important implications for frontline staff who are responsible for teaching persons with intellectual disabilities with severe deficits in communication skills. That is, pre-language instruction for such individuals might profitably start by teaching skills that are necessary to pass ABLA Levels 5 and 6. If an individual is able to pass Levels 5 and 6, what is the next step? Are there additional auditory discriminations that might serve as prerequisites to receptive and expressive communication skills?

With this question in mind, two prototype auditory matching tasks were examined. In auditory-auditory identity matching (AAIM), a participant hears three sounds, two of which are the same, and must indicate which of the two sounds are the same. Our research indicates that this type of auditory matching task is more difficult than ABLA Level 6 (Harapiak et al., 1999; Vause et al., 2000). Another type of auditory matching task involves recognizing that two sounds go together, even though they are different, such as accurately matching the spoken word "ice" to the spoken word "rink", and the spoken word "ball" to the spoken word "field." Our research indicates that this type of auditory-auditory non-identity matching (AANM) task is more difficult than ABLA Level 6 and AAIM (Harapiak et al., 1999; Vause et al., 2000). Moreover, for individuals classified at or above ABLA Level 4, the addition of the AAIM and AANM prototype tasks to the ABLA test differentiated individual communicative ability to a greater extent than did the ABLA test alone (Vause et al., 2000). Further, Marion et al. (in press) examined performance on the ABLA test, auditory matching tasks, and a test of vocal imitation, tacting, and manding. Results indicated that participants who passed only up to ABLA Level 4 passed 2% of the verbal assessments; participants who passed up to ABLA Level 6 passed 36% of the verbal assessments; and participants who passed Level 6, AAIM, and AANM passed 88% of verbal assessments. Considering these findings, it is suggested that AAIM and AANM tasks may serve as bridging tasks for learning basic language discriminations. Thus, the AAIM and AANM prototype tasks may be worthwhile additions to the ABLA test.

When assessing the addition of new diagnostic levels to the ABLA test, we need to keep in mind the following generalizations that have been demonstrated for each of the ABLA levels:

(a) ABLA tasks are hierarchically ordered in level of difficulty (as listed previously) such that individuals who pass at a certain discrimination level also pass at lower levels of the hierarchy, and those who fail at a certain discrimination level tend to fail at higher levels (Kerr et al., 1977; Martin, Yu, Quinn & Patterson, 1983; Wacker, 1981);

(b) each level has high test-retest reliability (Martin, et al., 1983);

(c) performance on the ABLA is highly predictive of the ease or difficulty with which individuals are able to learn educational and vocational tasks (Stubbings & Martin, 1995, 1998; Tharinger, Schallert & Kerr, 1977; Wacker, Kerr & Carroll, 1983; Wacker, Steil & Greenebaum, 1983);

(d) if a participant fails an ABLA level, then tasks requiring that ABLA level are difficult to teach using standard prompting and reinforcement procedures (Conyers, Martin, Yu & Vause, 2000; Witt & Wacker, 1981; Yu & Martin, 1986); and

(e) failed ABLA levels have been successfully taught using multiple-component training packages (e.g., Conyers et al., 2000; Hazen, Szendrei & Martin, 1989; Yu & Martin, 1986).

The present study examined whether the third generalization also holds for AAIM and AANM. Specifically, the predictive validity of the prototype AAIM and AANM tasks for single-syllable and two-syllable words, and for a sample of everyday common sounds was assessed. The study sought to confirm two predictions: (a) persons who failed the AAIM and AANM prototype tasks would fail all of the generalization tasks; and (b) persons who were able to perform both the AAIM and AANM tasks would pass all the generalization tasks.

Method

Participants and Setting

Participants were 18 adults with intellectual disabilities from the St. Amant Centre, a residential and community resource facility. Characteristics of participants are presented in Table 2. Sessions were conducted at the St. Amant Centre or in participants' group homes. The tester and two assistants were present in the test room during assessments.

Table 2: Characteristics of Participants

Partici-pant	*Sex*	*Age*	*Adaptive Functioning*	*Level of Functioning*	*Sensory Deficits*
1	M	29	Severe	Severe	None
2	F	32	Severe	Severe	Significant myopia / wears corrective lenses
3	M	26	Severe	Severe	Vision slightly worse in right eye / no corrective lenses
4	F	28	Severe	Severe	None
5	F	35	Severe	Severe	Farsighted / wears corrective lenses

Table 2: (cont'd)

Partici-pant	*Sex*	*Age*	*Adaptive Functioning*	*Level of Functioning*	*Sensory Deficits*
6	F	28	Severe	Moderate	None
7	M	25	Severe	Severe	Nearsighted
8	F	38	Severe	Severe	Left ear moderate hearing loss and right ear loss with negative middle ear pressure due to head colds
9	M	32	Severe	Moderate	Hearing aid in right ear / slightly farsighted / no corrective lenses
10	M	32	Severe	Moderate	Cataracts
11	F	41	Severe	Mild	Severe visual impairment due to macular degeneration / legally blind/ wears corrective lenses
12	M	35	Severe	Severe	Nearsighted / wears corrective lenses
13	M	36	Severe	Mild	None
14	M	30	Severe	Mild	None
15	M	41	-----	Mild	Wears corrective lenses

Table 2: (cont'd)

Partici-pant	*Sex*	*Age*	*Adaptive Functioning*	*Level of Functioning*	*Sensory Deficits*
16	F	35	Severe	Moderate	None
17	M	33	Severe	Mild	Nearsighted / wears corrective lenses
18	F	25	Mild	Mild	Tunnel Vision

Note. Adaptive functioning was measured using the Scales of Independent Behavior - Short Form (Bruininks, Woodcock, Weatherman & Hill, 1984); level of functioning was obtained from the clinical records at St. Amant Centre.

Procedure

Assessment on the AAIM prototype task. The tester was seated next to the participant. Two assistants were seated across the table, equidistant from the participant. On some trials, the tester said "pen, pen, pen." On other trials, the tester said, "block, block, block." Across trials, the two auditory cues were randomly alternated. Subsequent to presentation of the auditory cue by the tester, one assistant would imitate the tester by saying, "pen, pen, pen" and the other would say, "block, block, block." Across trials, the two assistants randomly alternated as to who would present the matching word and who would speak first. A correct response involved the participant pointing to the assistant who said the word that matched that spoken by the tester. An incorrect response involved the participant pointing to the assistant who did not match the word spoken by the tester. The pretest routine, reinforcement schedules for correct responses, and correction procedures for errors were the same as for the ABLA test (Martin & Yu, 2000). Similar to the ABLA test, the passing criterion was eight consecutive correct trials, and the failing criterion was eight cumulative errors.

Assessment of AAIM generalization tasks involving spoken words. The procedure was the same as that used with the AAIM prototype task, but the words used for the generalization tasks were different from the prototype task. Some tasks involved single-syllable words such as "glue" or "thread," and others involved two-syllable words such as "mirror" or "toothbrush."

Assessment of AAIM generalization tasks involving taped common sounds. The procedure used was that described by Lin, Martin and Collo (1995). Seating arrangements for the tester, assistants, and participant were the same as with the AAIM prototype task. For each trial, the tester turned on a tape recorder that presented a common sound (e.g., barking). One assistant would then play a tape recorder that presented the identical sound, and the other assistant would play a tape recorder that presented a different sound (e.g., meowing). Across trials, the tester randomly alternated the taped sound (e.g., barking or meowing), and the two assistants randomly alternated as to who played the matching sound and who played the sound first. All other aspects were similar to the assessment of the AAIM prototype task.

Assessment of the AANM prototype task. All aspects of this assessment were similar to the AAIM prototype task assessment, except for the sounds spoken by the tester and the assistants. On some trials, the tester would say "ball, ball, ball." On other trials, the tester would say, "ice, ice, ice." After the tester presented the spoken cue, one assistant would say, "field, field, field," and the other assistant would say, "rink, rink, rink." The correct response involved the participant pointing to the assistant who spoke the word associated with that spoken by the tester (i.e., ball to field and ice to rink).

Assessment of AANM generalization tasks involving spoken words. This assessment was the same as the AANM prototype task assessment, except that the words were different from the prototype task. Some of the generalization tasks involved single-syllable word matches (e.g., cold to frost and hot to burn), and some involved two-syllable word matches (e.g., coffee to filter and cassette to walkman).

Assessment of AANM generalization tasks involving taped common sounds. The procedure used was identical to the procedure for assessing AAIM generalization tasks involving taped common sounds, except for the sounds used. Examples of sounds that were an AANM match included the sound of an electric guitar matched to the sound of drums, and the sound of a violin matched to the sound of a flute.

Reliability Assessments

Interobserver reliability (IOR) data were collected for all of the ABLA assessments, 60% of the AAIM and AANM prototype task assessments, and 83% of the AAIM and AANM generalization task assessments. A participant's response was recorded simultaneously, and independently, by the tester and an assistant. An agreement was scored if both persons recorded the same response (correct or incorrect) on a given trial. In contrast, a disagreement was scored if the observers recorded different responses on a given trial. Percent agreement was determined, on a trial-by-trial basis, by dividing the number of agreements scored by the tester and research assistant during the session by the total number of agreements plus disagreements, and multiplying this number by 100% (Martin & Pear, 2003). The mean IOR agreements were: 100% for ABLA assessments, 98% for the prototype task assessments (range 95% - 100%), and 96% for the generalization-task assessments (range 92% - 100%).

Procedural reliability assessments were conducted for the prototype task assessments and the generalization task assessments. During the first 10 trials of a session, two assistants recorded whether the tester followed the procedure based on a procedural checklist. Procedural reliability checks were obtained for 25% of the AAIM and AANM prototype task assessments, and 30% of the AAIM and AANM generalization task assessments. Procedural reliability agreements were calculated in the same manner as described for IOR assessments, and were 100% in all cases.

Results

The results of the generalization assessments (and predictions confirmed) are presented in Table 3. First, 93% of predictions were confirmed for persons who passed Level 6 and failed the prototype tasks (see participants 1-10). Second, 100% of predictions were confirmed for persons who passed Level 6 and the AAIM and AANM prototype tasks (see participants 11-18). Overall, the outcomes on 96% of the assessments were consistent with the predictions.

Chi-square analyses were conducted to assess statistical significance between each prototype task and the four types of predictive tasks (i.e., AAIM, spoken words; AAIM, taped sounds; AANM, spoken words; AANM, taped sounds). To be considered a pass, a participant needed to obtain at least 50% on a particular type of predictive task. For example, Participant 9 passed 1 out of 2 of the AAIM tasks involving taped sounds, which would be considered a pass, whereas Participant 8 passed 1 out of 4 of the AANM tasks involving speech sounds, which would be considered a fail. Results for the four types of predictive tasks, in order (see Table 3), were: $X^2(1)=18.00$, $p<.0001$; $X^2(1)=9.16$, $p<.01$; $X^2(1)=18.00$, $p<.0001$; and $X^2(1)=11.52$, $p<.001$.

Table 3: Test Results on Generalization Tasks Passed

Partici-pants	*Highest ABLA & Prototype Tasks Passed*	*AAIM (Speech Sounds) G.T.*	*AAIM (Taped Sounds) G.T.*	*AANM (Speech Sounds) G.T.*	*AANM (Taped Sounds) G.T.*	*Percent Predictions Confirmed by Participants*
1	ABLA	0/ 4	0/ 2	0/ 4	0/ 2	93%
2	Level 6	0/ 4	0/ 2	0/ 4	0/ 2	
3		0/ 4	0/ 2	0/ 4	0/ 2	
4		0/ 4	0/ 2	0/ 4	0/ 2	
5		0/ 4	0/ 2	0/ 4	0/ 2	
6		0/ 4	2/ 2	0/ 4	2/ 2	
7		0/ 4	0/ 2	0/ 4	0/ 2	
8		0/ 4	0/ 2	1/ 4	0/ 2	
9		0/ 4	1/ 2	0/ 4	0/ 2	
10		0/ 4	2/ 2	0/ 4	1/ 2	
11	ABLA	4/ 4	2/ 2	4/ 4	2/ 2	100%
12	Level 6,	4/ 4	2/ 2	4/ 4	2/ 2	
13	AAIM, and	4/ 4	2/ 2	4/ 4	2/ 2	
14	AANM	4/ 4	2/ 2	4/ 4	2/ 2	
15		4/ 4	2/ 2	4/ 4	2/ 2	
16		4/ 4	2/ 2	4/ 4	2/ 2	
17		4/ 4	2/ 2	4/ 4	2/ 2	
18		4/ 4	2/ 2	4/ 4	2/ 2	

Discussion

This study indicates that the AAIM and AANM prototype tasks have high predictive validity for matching spoken single-syllable and two-syllable words, taped single-syllable and two-syllable words, and taped common sounds.

As mentioned previously, when assessing the addition of new diagnostic tasks to the ABLA test, we need to keep in mind the following generalizations that have been demonstrated for each of the ABLA levels: (a) each level has a consistent level of difficulty in the ABLA hierarchy; (b) each level has good test-retest reliability; (c) each discrimination task has good predictive validity for other discriminations at that level; (d) failed levels are difficult to teach using standard prompting and reinforcement procedures (Martin & Yu, 2000); and (e) failed ABLA levels can be successfully taught using multiple-component training procedures (e.g., Conyers et al., 2000). The present study, in conjunction with previous research (Harapiak et al., 1999; Vause et al., 2000) indicates that the first three of these generalizations have now been demonstrated for the AAIM and AANM prototype tasks. That is, they are both more difficult than ABLA Level 6, AANM is more difficult than AAIM, they have good test-retest reliability, and they have good predictive validity for other AAIM and AANM discriminations.

For participants who fail at least one of the ABLA levels, the ABLA test is useful for matching the learning ability of such participants to the difficulty level of training tasks. However, for individuals who pass all six ABLA levels, the test has much less predictive value in that such clients are able to accurately perform tasks at all of the ABLA levels. In a study of 117 individuals: (a) no individuals classified as persons with profound mental retardation passed all six ABLA levels; (b) some persons with severe mental retardation passed all six levels by their 18th year of age, but many did not; (c) all persons classified with moderate mental retardation passed all six ABLA levels by their 15th year; and (d) all persons classified with mild mental retardation passed all six ABLA levels by their 11th year (Kerr et al., 1977). Thus, to increase the utility of the ABLA test for many persons with moderate or mild mental retardation, it is necessary to add levels with difficulty beyond Level 6. The AAIM and AANM prototype tasks appear to be very worthy candidates to consider adding to the ABLA test.

The present results are limited by a relatively small sample, and by an absence of individuals who passed up to AAIM and failed AANM. Research with additional participants is needed to replicate the current observations. Future research might explore whether AAIM and AANM tasks involving common sounds are easier to perform than the same tasks involving speech sounds, as well as whether there is a difference in performance when speech and/or common sounds are presented "live" versus "taped." Of interest in this study was the finding that three individuals (participants 6, 9 and 10) who passed up to ABLA Level 6 (see Table 3) and failed both the prototype tasks were able to pass some AAIM and AANM generalization tasks involving taped environmental sounds.

Future research also needs to examine if, like the ABLA levels, failed AAIM and AANM prototype tasks are extremely difficult to teach using standard prompting and reinforcement procedures. If this is the case, can we teach these discriminations using a multiple-component training package that has proved useful in teaching ABLA levels? Considering the results of previous research (e.g., Marion et al., in press; Vause et al., 2000), it is possible that acquisition of AAIM and AANM may lead to improvements in communication skills.

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