EMPIRICAL REPORT

Conducting Behavioral Research with Children Attending Nonbehavioral Intervention Programs for Autism: the Case of Lebanon

Nidal Daou

Published online: 30 August 2014

© Association for Behavior Analysis International 2014

It has been almost 50 years since the inception of applied behavior analysis (ABA). As advocates for ABA would argue, people living with autism *deserve* to receive behavioral intervention for a multitude of reasons, an important one pertaining to learning to perform tasks independently (Walsh 2011). Twenty years ago, MacDuff et al. (1993) introduced the world to an important line of research and people with autism to a valuable intervention procedure that teaches them to become autonomous. Activity-schedule following could be as simple as flipping through a small binder containing sheets with an activity photographed on each (MacDuff et al. 1993) and as sophisticated as using hand-held or tablet computers to manage daily or weekly tasks (Fenske and MacDuff 2011). Activity schedules have been used with people with autism belonging to different age groups, having different skill sets, and for teaching different response classes (e.g., Blum-Dimaya et al. 2010; Bryan and Gast 2000; Machalicek et al. 2009; Miguel et al. 2009; see also Koyama and Wang 2011 for a review). Taking it an important step beyond achieving proficiency in following activity schedules, behavior analysts have taught children with autism to follow activity schedules collaboratively to improve peer engagement (Betz et al. 2008; White et al. 2011; see also Banda and Grimmer 2008 for a review).

Although the present study did not expand upon the latest advancements in this line of research, its modest, modified replication of the original MacDuff et al. (1993) study was a stepping-stone given the context in which it was conducted. The referenced context pertains to the absence of ABA or behavioral intervention outside the scope of participation, which might make this study relevant to behavior analysts in (mainly

developing) countries with minimal behavioral services. Even though ABA has been the top empirically supported and recommended treatment for autism spectrum disorders since the turn of the century (Department of Health 1999;¹ Department of Health and Human Services 1999; Gill 2001; Jacobson 2000; Rosenwasser and Axelrod 2001), it is only scarcely available in Lebanon. This scarcity is evidenced by the fact that Lebanon's first and most well-established NGO dedicated to autism advocacy and awareness, the Lebanese Autism Society, provides services from multiple disciplines, with an approximation to ABA only recently introduced to select classes (Arwa El-Amine Halawi, personal communication, May 7, 2012). This scarcity is also evidenced by the fact that multidisciplinary interventions, including music therapy and kinesiology, are provided even in one of the very few institutes that advocate for the use of ABA in autism intervention in Lebanon (Autism Learning Institute for ABA, as presented in the Institute's brochure and Facebook page²). Perhaps the greatest evidence stems from the absence of evidence in the form of publications of research reports concerning the use of ABA in Lebanon. After all, behavior analysts (e.g., Buffington et al. 1998; Green 2001; Krantz and McClannahan 1993, 1998; Lovaas 1987; MacDonald et al. 2007; MacDuff et al. 1993; Reeve et al. 2007; Taylor and Hoch 2008; Taylor and Levin 1998; White et al. 2011), true to the scientist-practitioner model to which we aspire (Sidman 2011)—to the “applied” and “analysis” in ABA (Baer et al. 1968)—have a history of contributing to their communities with their research as with their interventions. The apparent absence of publications emerging from Lebanon on behavioral intervention in autism speaks to the state of ABA in this country.

A look at the research articles and reports³ concerned with autism spectrum disorders, published in *JABA* between 2007

N. Daou (✉)

Department of Psychology, American University of Beirut,
Beirut 1107 2020, Lebanon
e-mail: nn07@aub.edu.lb

N. Daou
e-mail: nidal.daou@gmail.com

¹ Cited with permission of the New York State Department of Health.

² Under the Facebook group “ALI for ABA Autism Lebanon.”

³ I am indebted to Ms. Camelia Harb for assisting with tedious aspects of this review of the 112 *JABA* articles.

and 2012, revealed not only that just one of the 112 studies was conducted in a developing country (Turkey;⁴ Ulke-Kurkcuoglu and Kircaali-Iftar 2010) but also that just one of the 112 studies (Ingvarsson and Hollobaugh 2011) explicitly stated that their “participants had not received early and intensive behavioral intervention services” (p. 660). Similarly, none of the 13 studies concerned with autism spectrum disorders and published in *BAP* since its first issue in 2008 were conducted in a developing country; all were conducted in the USA (e.g., Hoch et al. 2009; Parsons et al. 2012) and most involved participants who had been receiving behavioral intervention outside the research context (see Table 1 for more details). This finding is not surprising and it speaks to the prevalence of behavioral-based intervention programs in North America and Western Europe, which is arguably an advantage for behavior analysts there, because it grants them easier access to potential participants. It also provides a better chance of receiving the approval of relevant gatekeepers, whether parents/guardians, school principals or program directors, or institutional review boards, due to the commonality of such requests, and allows for better use of research time and resources by lessening the need for prerequisite-skill acquisition within the research context.

Involving children not previously exposed to behavioral intervention, the present study was based on MacDuff et al. (1993), with the primary purpose of using photographic activity schedules, reinforcement, graduated guidance, prompting, error correction, and backward chaining to teach children with autism to independently engage in leisure activities. Conducting a study of this type, 20 years after the publication of the original study that inspired it, along with scores of others advancing upon its technology, is still important given that the participants in the present study had no prior history with behavioral intervention but rather interventions whose outcomes, in several respects, competed with goals of behavioral intervention, including decreasing stereotypic behavior and teaching independent engagement.

The present study adds to literature on activity schedules in that it abandoned an original, literature-recommended (e.g., McClannahan and Krantz 2010) goal to address prerequisite skills normally taught to mastery prior to delving into activity schedules, as they proved to be too numerous and difficult to manage in the restricted time of the study and its sessions. Instead, the present study taught all skills necessary for independent engagement in leisure activities incidentally, during the course of baseline and treatment phases, as applicable. Responses that were targeted during sessions throughout the study included learning to respond to individualized motivational systems, increasing attending responses, reducing or eliminating stereotypic and problem behavior (e.g., echolalia, excessively slow responding on basic tasks, vocalizing), and

improving upon or introducing prerequisite skills necessary for independent engagement in leisure activities (e.g., tolerating prompts, learning to play with numerous age-appropriate games and activities originally not in the participants’ repertoires, learning to match pictures to objects, learning to use Ziploc bags in which puzzle and Lego pieces were stored, also not originally in any of the participants’ repertoires).

Method

Recruitment and Participants

The participants were two boys and one girl enrolled at a private school for students with autism. All had a diagnosis of autism, obtained from an independent agency. The school was not behavioral in orientation, and the participants had not received behavioral intervention prior to their enrollment in the present study nor did they receive behavioral intervention outside the research sessions. It is noteworthy that school officials did not recruit the experimenter to conduct the study. The experimenter initiated contact with them and sought their approval to recruit participants. Given the negative views they had had about ABA, the administrators expressed willingness to involve their students following a detailed presentation of the study goals and procedures by the experimenter. Then, they distributed recruitment letters to parents of all children with autism who were 4–7 years of age. Five parents responded favorably, demonstrating an interest in attending the informed consent meeting, at which the investigator explained the study objectives, nature of procedures, and ethical boundaries (e.g., potential risks and benefits, confidentiality, etc.). Four parents provided informed consent and, ultimately, three children participated.⁵ It was not possible to determine the precise reasons that led parents to decline participation, as they were not asked to justify their decision formally. Seasoned staff members explained, however, that the study’s behavior analytic orientation was discouraging at least to some parents. This negative perception was typically due to (a) the misrepresentation and damage brought about by some pseudo-professionals claiming to be ABA therapists, who in fact had no academic background or training in ABA, and (b) the misconception that the behavior of children receiving behavioral intervention was “robotic” and restricted.

Nevertheless, despite the fact that recruitment was not based on referrals relating to difficulties in remaining on-task or appropriately engaged, the participants’ caregivers cited their respective child’s lack of independent-engagement skills as problematic and as a recurring concern that interferes with their family functioning. It was not in the

⁴ According to International Monetary Fund (2012).

⁵ The fourth student participated for only two and a half months, as his family relocated to another country. His participation is not included here.

Table 1 Summary of the context for research in published literature

	Of the 112 autism studies published in <i>JABA</i> (2007–2012)	Of the 13 autism studies published in <i>BAP</i> (2008–2012)
Conducted in a developing country	1 (Ulke-Kurkcuoglu and Kircaali-Iftar 2010)	0
Participants had <i>not</i> received behavioral intervention outside research context	1 (Ingvarsson and Hollobaugh 2011)	0
One/some/all participants received at least some behavioral intervention outside research context	57 (e.g., Betz et al. 2008; Cassella et al. 2011; Charania et al. 2010; Tarbox et al. 2007)	11 (e.g., Libby et al. 2008; Parsons et al. 2012)
Participants had been attending schools for people with autism or developmental disorders	20 (e.g., Morrison et al. 2011)	0
Participants had been attending integrated or general-education schools	8 (e.g., Petursdottir et al. 2007)	0
No mention of educational or intervention history of participants	26 (e.g., Axe and Sainato 2010)	2 (Geiger et al. 2012; Kliebert et al. 2011)

participants' repertoire to work independently or to rely on activity schedules, but rather to follow verbal instructions, and physical and gestural prompts delivered by their caregivers and teachers.

On the first day in baseline, Alan was 5 years 10 months old, Ava was 6 years 7 months old, and Max was 6 years 11 months old. Alan and Max's participation lasted approximately 11 months. This period included summer vacation and other school-observed holidays, but it excluded follow-up sessions held 1 to 4 months following treatment. Ava's participation lasted 14 months.

Alan had moderate-to-mild autism. His language functioning and listening comprehension were equivalent to the pre-school level. He engaged in delayed echolalia most of the time. Even though he engaged in echolalia during sessions, it was severe and disruptive only toward the beginning of the study. Ava had a severe form of autism. She was nonverbal, with no expressive communication skills and limited receptive skills. Ava engaged in noncontextual laughing, crying, and vocalization that varied in intensity and volume, and she engaged in tensing and aggressive behavior, mainly in the form of darting and pinching. Max was high-functioning. His language functioning and listening comprehension were equivalent to the first-grade level. He engaged in minimal stereotypic behavior. At the time of the study, he was integrated in classes at a general-education school, and he attended the center-based program only for speech therapy.

Prior to the beginning of this study, reinforcement schedules and motivational systems were not embedded in the participants' regular intervention programs at school. Moreover, participants did not respond reliably to one-step directions. Even though they were Lebanese students whose parents spoke to them in colloquial Lebanese Arabic, the language of instruction at their school was predominantly French (which is typical of Lebanese schools, to have English- or French-based instruction). The language used by

the experimenter was predominantly colloquial Lebanese, however. French was used in rare occasions and only with Max when verbal prompting was necessary for the correct completion of select puzzles.

Setting and Materials

All sessions were conducted in an unoccupied classroom, equipped with desks, chairs, cabinets, and a computer. During a session, age-appropriate games and stimuli needed to complete the target activities were spread through the surfaces of three to six desks that were joined together. Activities included 4- to 27-piece wooden puzzles, 12- to 48-piece regular puzzles, single-player memory games, magnetic boards, books, blocks, and, additionally for Ava, snacks. The same games and activities were presented across phases, with new varieties (e.g., equivalent-level puzzles depicting different pictures/themes) introduced periodically. For all participants, colored photographs (between 5 cm×9 cm and 7 cm×10 cm) of each item to be used in the activity schedules were each placed on letter-sized white paper within sheet protectors in three-ring binders. In an attempt to reduce the possible distraction of the large white paper background, larger photographs (between 8.5 cm×15.5 cm and 17 cm×18 cm) were used with Ava, starting in treatment session 17 (session 56). During treatment and follow-up, activity schedules were placed on a table adjacent to the activities area. A few meters away, a participant sat at a table that contained his or her motivational system (described below). Select sessions were videotaped on an iPhone 3G.

General Procedures

Experimental sessions were conducted 1 to 3 days a week on schooldays that spanned across 11 months (Alan and Max) and 14 months (Ava). The author conducted all sessions. A

session lasted from 15 to 55 min, depending on the phase and participant. On average, a session lasted 20 min with Ava and 30 min with Alan and Max. On average, Ava completed eight activities (range, 1–12) per session, approximately two of which were snacks. Alan and Max completed nine activities (range, 4–15) per session.

Dependent Measure and Response Definitions

The dependent variable consisted of two components, one of which was further divided into five subcomponents (see Table 2). Specifically, the dependent variable was independent engagement in leisure activities, which, consistent with McClannahan and Krantz (2010), constituted (a) on-task behavior and (b) independent completion of activity-related components. On-task behavior was defined in accordance with MacDuff et al. (1993), and it consisted of manipulating stimuli needed for the task or component at hand appropriately, in the absence of problem behavior (e.g., noncontextual laughing), stereotypic behavior, and distraction by non-activity-related stimuli for longer than 5 s.

Based on the steps suggested by McClannahan and Krantz (2010), independent completion of activity-related components included open schedule book or turn page, point to or look at the photograph depicting a toy or snack, obtain the item that matches the photograph, complete the activity, and return the item to its place. The first component ensured that the participant went through the experimenter-designated sequence of activities as displayed in the schedule book. That sequence and the activities, themselves, were consistently rotated. The second component consisted of a response—whether orienting toward, looking at, or touching with finger(s) the photograph—that demonstrated that the participant had attended to the photograph of the next scheduled activity. With slight deviations from McClannahan and Krantz (2010), obtaining (component three) and returning (component five) the item consisted of two subcomponents each. Obtaining the

photographed item (i.e., the scheduled activity) involved (a) identifying and selecting it from amongst all other items displayed on the activities table and (b) opening the Ziploc bag that contains items necessary for completing the scheduled activity and taking out those items to be manipulated during the completion phase. By the same token, returning the item to its place involved (a) packing the items and sealing the Ziploc bag and (b) leaving the desk with the item and returning it to its place on the activities table. Completion (component four) of scheduled activities was unique and constituted another deviation from McClannahan and Krantz (2010), as it was treated as an opportunity to assess the participants' on-task behavior, which was required for all other components as defined above, but for completion in specific, the requirement was for the participant to complete or attempt the game or activity, even if not independently. The rationale for this distinction was that all the leisure activities introduced in the present study were novel to the participants, requiring numerous training opportunities before independent and accurate completion could be achieved.

Data were collected using pen and paper. The dependent measure was the percentage of independent-engagement components completed correctly. The percentage of independent engagement was calculated as follows: number of correctly completed components across all activities used in a session divided by the total number of components multiplied by the number of activities used, with the quotient multiplied by 100. A component was considered correct if it were completed correctly and independently (with the exception of the completion component, which allowed for attempting to complete, thus did not require independent completion of activities) within 5 s of exposure to the discriminative stimulus that evoked it and while the participant remained on-task. A participant was considered on-task during the completion component, even if he or she were receiving help from the experimenter. An incorrect response meant that a component was not completed independently or correctly, within 5 s of its

Table 2 Response definitions for target behavior

Dependent variable	Subcomponents	Response definitions
Independent engagement in leisure activities	On-task behavior	Manipulating stimuli appropriately, in the absence of problem behavior, stereotypic behavior, and distraction by non-activity-related stimuli for longer than 5 s
	Independent completion of activity-related components	Opening schedule book or turning page
		Pointing to or looking at the photograph depicting a toy or snack
		Obtaining the item that matches the photograph: (a) selecting item from amongst all other displayed items and (b) opening the Ziploc bag that contains items necessary for completing the activity and taking out those items to be manipulated
		Completing the activity: completing or attempting the game or activity, even if not independently
		Returning the item to its place: (a) packing the items and sealing the Ziploc bag and (b) leaving the desk with the item and returning it to its place on the activities table

occasion. A component was scored as incorrect also if the participant engaged in disruptive behavior (e.g., loud or noncontextual vocalization) or was off-task for longer than 5 s. For Ava, however, and starting with the fourth-to-last session in baseline, a correctly completed component was marked correct even if emitted along with low-volume vocalization, because it was very rare for Ava to be completely quiet for the duration of a minute. Moreover, her low-volume vocalizations did not appear disruptive or socially inappropriate, as judged by the experimenter and based upon interobserver agreement. This did not hold for loud vocalizations, including screams and screeching sounds exceeding the normal conversation volume.

Experimental Design and Conditions

A multiple-baseline-across-participants design was used to assess the effects of a treatment package (see below) on independent engagement in leisure activities for three children with autism who had not received behavioral intervention prior to involvement in the present study. A brief prebaseline phase, which consisted of two (Alan and Ava) or three (Max) sessions, was originally designed to teach prerequisite skills identified in the literature (e.g., McClannahan and Krantz 2010) as necessary for independent engagement. The experimenter attempted to assess and train prerequisite skills, including picture-object correspondence and identical-object matching, using discrete-trial training held in one-to-one sessions. The novelty of this type of training, however, and the extent to which it proved to be discrepant with the type and structure of instruction provided outside the research context (i.e., in the classroom, at home, etc.) suggested that prebaseline would be too laborious to be managed within the scope and time allotted for this study, especially given the ratio of number/duration of research sessions (one to three sessions a week, each lasting an average of 20–30 min) to the number/duration of nonbehavioral intervention the participants received at their school and home (most waking hours of most days of the week).

Following the termination of the prebaseline phase, the experimenter initiated the session by providing the instruction “Play with your toys” or “Do your work.” What followed depended on the phase in effect. In baseline, if a participant did not respond to the instruction at all, the experimenter would place toys and games, one after another, on the desk in front of the participant. An item was removed after the activity it evoked was completed (e.g., after a puzzle was put together) and after giving the participant 5 s to return the item himself or herself to the activities table. The experimenter used verbal prompts, graduated guidance, backward chaining, and reinforcement (see descriptions below) to teach participants to manipulate the games appropriately. No intervention or reinforcement was provided for obtaining or returning

items. Baseline data were obtained on only three of the five components: obtaining material, completing the activity, and putting material away. The remaining two components, opening schedule book or turning page and pointing to or looking at the photographed activity were excluded in baseline as they necessitated the presence of the activity-schedule book, which was introduced in treatment. Baseline was concluded for each participant when stable performance was observed.

In treatment, the treatment package (described below) was implemented. Max entered treatment first, followed by Alan, and finally Ava. Max and Alan had approximately the same number of sessions (40 and 42 sessions of baseline and treatment combined for Alan and Max, respectively); Ava had 58 sessions across the two phases. Finally, two follow-up sessions that were identical to baseline conditions, except for the presence of the activity-schedule book on a desk near the toys, were conducted with Alan and Max 5–9 and 13–16 weeks after treatment. No follow-up sessions were held with Ava.⁶

Independent Variable

The independent variable was a treatment package consisting of the use of photographic activity schedules, reinforcement, graduated guidance, prompting, error correction, and backward chaining.

Activity Schedules Schedule books (described in the “Setting and Materials” section above) were not in the participants’ repertoires prior to their enrollment in the present study. Photographic activity schedules were introduced in treatment as a means to teach the participants to become independently engaged in leisure activities.

Reinforcement Reinforcement was provided in two ways. First, regardless of performance on independent-engagement components, reinforcement was provided for appropriate attending behavior and for the absence of disruptive behavior (e.g., keeping quiet, sitting properly). Second, reinforcement was provided contingent upon correctly manipulating games or toys (baseline) and completing independent-engagement components (treatment). In both cases, reinforcement was provided using individualized motivational systems, with which participants were not familiar before enrollment in the present study, and behavior-specific praise, which had never been part of formal programming outside the context of the present study. Therefore, participants learned to respond to an individualized token system, whereby a preferred primary reinforcer (e.g., bite-size chocolates or pretzels, piece of chips, or sip of water) was delivered contingent upon one target

⁶ Ava’s participation ended simultaneously with the ending of the academic year, after which she moved to a new school.

response at first, then it was paired with one token (a ladybird or star, 2 cm in diameter each), and then more tokens were earned before being exchanged with the primary reinforcer. For all participants, eight to ten tokens were eventually earned before access to primary reinforcement was granted. Given the purpose of the present study to promote independent engagement, behavior-specific praise was used sparingly so as not to embed the experimenter's voice in the target behavior. Therefore, there was more reliance on the silent delivery of token reinforcement, with the experimenter consistently present behind the participant throughout the study. Behavior-specific praise was used at the beginning of the study, when it was necessary to teach the association between tokens and primary reinforcement. Both, praise statements and tokens were systematically faded, from a fixed interval schedule of 5 s contingent upon appropriate attending behavior in baseline to a variable interval of 5 min, as the sessions progressed and the participants demonstrated improvement in on-task behavior and independent engagement in treatment, at which point only tokens were delivered. A less structured schedule was used for increasing the number of tokens exchanged for primary reinforcement. Token economy was taught by the exchange of one token with a primary reinforcer, and it quickly (following one or two sessions) increased to two tokens. The transition from two tokens to eight (Ava) and ten (Alan and Max) was achieved gradually, at a pace that depended upon individualized performance (mainly on-task behavior).

Graduated Guidance, Prompting, and Error Correction Graduated guidance (see MacDuff et al. 1993; McClannahan and Krantz 2010 for details) was used to teach participants to play with the target games and toys (throughout the study) and to teach them to independent-engagement skills (during treatment). Prerequisite skills that are necessary for independent engagement were taught, as needed, during the course of a session, not in isolation. For example, Max reacted unfavorably to manual guidance initially, by freezing and tensing his muscles. Even though tolerating prompts and manual guidance is listed among the necessary prerequisites (McClannahan and Krantz 2010), it was not taught in isolation in prebaseline; instead, in response to his first and subsequent inappropriate reactions to this procedure, a correction procedure was in effect. Error correction consisted of verbal prompting (e.g., "Let me help you"), response cost (loss of earned tokens), and differential reinforcement of other (incompatible) behavior (e.g., behavior-specific praise, "Thanks for letting me help you," and token delivery contingent upon appropriate acceptance of manual guidance). Because of difficulties often associated with fading verbal prompts or transferring stimulus control away from the prompts (MacDuff et al. 1993), they were used sparingly, with more reliance on nonverbal forms of feedback (mainly token reinforcement, manual guidance, and response cost). Another

prerequisite skill that was taught after treatment had started was for Ava to match pictures to objects. To do so, larger sized photos of activities were included in her schedule book as of treatment session 17.

Backward Chaining A backward-chaining procedure was used to teach participants to play with items that were difficult for them to learn, mainly large puzzles, blocks, and memory games. These skills were taught throughout baseline and treatment phases, as needed and during the course of a session, not in isolation. If a participant did not complete a newly introduced game independently while maintaining 80 % accuracy with good speed, the experimenter would have few steps completed before the participant accessed the game. As performance improved, fewer steps until no steps would be precompleted.

Interobserver Agreement

The experimenter (author) trained members of the Department of Psychology at the American University of Beirut (five undergraduate students, three graduate students, and one MA-level instructor) on the definitions and measurement of the dependent variables. The experimenter and secondary observers obtained point-by-point interobserver agreement (IOA) on each response component, across all phases on 48 % (Alan), 66 % (Ava), and 43 % (Max) of the sessions. Before their data could be used, observers were trained to a criterion of at least 80 % IOA on two consecutive sessions. The percentage of IOA was calculated by dividing the number of agreements by the total number of agreements and disagreements, then multiplying the quotient by 100. The agreement data were high, with a mean of 94.65 % (range, 60–100 %), 92.76 % (range, 75–100 %), and 97.37 % (range, 86–100 %) for Alan, Ava, and Max, respectively.

Given the shortage of ABA-trained therapists, aside from the experimenter, and the lengthy training time required for others to obtain a valid and reliable measure of procedural integrity, this measure was obtained only on 2 % of the sessions; one session with Ava and one with Max, toward the end of treatment. Reliability measures were obtained on the presentation of all stimuli associated with a given trial, and on the delivery or withholding of consequences in each trial. Despite the very low percentage of sessions on which this measure was obtained, the score was 98.9 % reliability.

Social Validity Measure

A social validity measure was used to assess the extent to which the treatment package was effective in teaching the participants to play independently and in a socially appropriate manner. To accomplish this, ten experimentally naïve students (three undergraduates, six graduates, and one

postdoctoral fellow) enrolled at the American University of Beirut and not familiar with the present research or its participants were asked to complete two questionnaires designed for this study.

The first asked them to judge the effectiveness of treatment upon viewing segments of videotapes of responding emitted in baseline and in treatment. Six pairs of clips were presented, with two pairs per participant, with the order of presentation randomly assigned across participants, and with the sequence of presentation of segments within each pair randomly assigned across phases. The scorers were asked to judge which segment of each pair was better with respect to (a) social appropriateness, which was defined as having the child work “in a socially acceptable manner, not engaging in disruptive behavior, not vocalizing/singing/engaging in echolalia” (which was defined for the scorers); and (b) independent engagement, which was explained to mean that “the child was on task and self-reliant with respect to obtaining an activity to play with, playing with it, and then returning it to its place.” The scorers were also informed, orally and in writing, that “Playing with an activity was still considered independent if the child needed assistance from an adult because of game difficulty (not because he or she was off task or inappropriately engaged).” The scorers were asked to make a forced choice between the first and second trial per paired segments. Following their viewing of each pair, they were asked whether they believed the child was (a) appropriately engaged and (b) independently engaged in his or her activities. They were given four choices for each of the two questions: whether appropriate/independent engagement was observed in (a) the first trial, (b) the second trial, (c) both trials, in which case scorers had to determine which of the two trials they thought was better (hence the forced choice), and (d) neither trial, in which case, here too, scorers had to determine which of the two trials they thought was better. The data for this measure were summarized as the percentage of correctly identified trials when excluding the “both” and “neither” options (conservative measure), and when those options were included, but the treatment trial was correctly selected as the better of the two (nonconservative measure).

To assess whether changes in behavior were meaningful, a second social-validity measure was used. It included nine segments of video footage randomly selected from baseline and treatment phases with the three participants, whose order of presentation was randomly assigned. Scorers answered the following questions upon viewing each segment: (a) The child’s behavior was socially appropriate, (b) the child was independently engaged, (c) the child was making a good use of his or her time, (d) this event occurred before treatment, and (e) this event occurred after treatment. Each question included a 5-point Likert scale.

Results

Acquisition of Prerequisite Skills

Familiarity with token reinforcement and acquisition of prerequisite skills occurred only during research sessions, as these technologies were not used with the participants before or outside the research context and their acquisition prior to the start of the main study was projected to have been too laborious to manage. With Ava, the token reinforcement system increased gradually to eight tokens in session 47 (the tenth treatment session). Alan and Max’s tokens reached ten in sessions 23 (second-to-last baseline session) and 3 (last baseline session), respectively. With respect to prerequisite skills, all participants needed to learn to (a) play with the games used in the present study, (b) respond to one-step directions, (c) accept manual guidance, and (d) demonstrate picture-object correspondence. Although these skills were believed to have been in Alan and Max’s repertoires, neither they nor did Ava demonstrate these skills when asked in discrete-trial format.

With the exception of the 48-piece regular puzzle (with Max) and the 12-item multipicture blocks puzzle (with Alan) that continued to require prompting, all participants learned to play all games assigned to them completely independently toward the end of treatment. Participants learned to respond to the experimenter’s one-step directions only after receiving training on individualized motivational systems. Responding to one-step directions was necessary as the present study occasionally used directions, such as “Let me help you,” to encourage acceptance of manual guidance, and “Work quietly,” to help decrease noncontextual vocalizations and echolalia. Through reinforcement, Alan learned to work quietly and quickly during sessions. Finally, both Alan and Max demonstrated picture-object correspondence as soon as treatment started, attending to the picture as opposed to background following the introduction of treatment. Ava required more sessions in treatment to demonstrate this skill, however. Despite the improvement in her overall performance over the next 11 sessions (see Fig. 1), Ava still failed to obtain materials other than the snack independently. Her obtaining performance improved tremendously with the insertion of larger sized photos of activities as of treatment session 17.

Baseline, Treatment, and Follow-Up Phases

The implementation of the treatment package resulted in a systematic increase in the percentage of independent-engagement components completed correctly from baseline to treatment across the three participants (see Fig. 1). Alan’s independent engagement improved from an average of 19.05 % in baseline to 93.28 % in the last eight sessions in treatment. Ava’s performance improved from an average of 4.66 % in baseline to 60.17 % in the last eight sessions in

treatment. Max's performance improved from an average of 34.68 % in baseline to 95.98 %, excluding the session in which he scored 0 %, as it was aberrant and a function of other events that had taken place prior to that research session (including the 0 % would yield an average of 83.69 % in the last eight sessions in treatment).

A look at baseline performance reveals that all participants completed some independent-engagement components correctly prior to the implementation of treatment (see Fig. 1).⁷ The last four sessions in baseline for Ava appeared to have shown an improvement in performance, but this was only a function of a change in the response definitions for independent-engagement components. As described in the "Method," Ava's correct completion of components was no longer marked incorrect if accompanied by low-volume vocalizations. This led to an apparent improvement in performance toward the end of baseline, when it was only reflective of the change in response measurement. Despite this leniency in measuring her behavior, Ava's performance continued to be the poorest and by far the slowest to improve, remaining in treatment even after Alan and Max had completed follow-up sessions. Nevertheless, Ava's independent-engagement responses improved steadily throughout treatment, increasing from an average of 13.5 % in the first ten treatment sessions, to 26.99 % in the second block of ten sessions, to 41.28 % on the third block, and to 60.17 % in the last eight sessions in treatment. Her participation ended, however, with the ending of the school year.

Follow-up sessions held with Alan and Max demonstrated generalization of independent engagement in leisure activities across time. Both participants picked up the activity-schedule book once they were given the instruction to do their work and followed it during the course of both sessions. They each obtained 100 % correct on the first follow-up session and 96 % (Max) and 89 % (Alan) on the second.

Social Validity

With respect to the first measure of social validity, scorers correctly identified posttreatment trials across participants in 98 and 97 % of the trials presented, judging by the participants' independent engagement and social appropriateness, respectively. These data were based on the nonconservative measure, which included the both and neither options, with

⁷ With Alan, one could see an improvement and subsequent stability in baseline performance starting with the fifth baseline session. The observed increase in target behavior might have been the result of reinforcement for engaging in appropriate attending behavior (especially targeting echolalia) that Alan received during the two prebaseline sessions and the first few sessions in baseline. This was reflected in Alan's baseline performance, as his scores on completion improved as a function of appropriate attending.

Table 3 Social validity questions and average ratings for both conditions

Question	Baseline	Treatment
The child's behavior was socially appropriate	1.71	4.21
The child was independently engaged	2.03	4.55
The child was making a good use of his or her time	1.83	4.32
This event occurred before treatment	4.26	1.43
This event occurred after treatment	1.63	4.57

Items were rated on a Likert-type scale of 1 (*strongly disagree*) to 5 (*strongly agree*)

the treatment trial correctly selected as the better of the two. The conservative measure, which excluded the both and neither options, resulted in scorers identifying participants as looking more independently engaged and socially appropriate in the postintervention trial 80 and 82 % of the time, respectively.

The second social-validity measure showed that scorers rated postintervention trials more favorably with respect to social appropriateness, independent engagement, and good use of time. They also could determine reliably whether a trial had occurred in baseline or treatment (see Table 3).

Discussion

The present study was based upon the landmark study of MacDuff et al. (1993), involving three children with autism who had not received behavioral intervention prior to their participation. The present study demonstrated that systematic increases in independent engagement in leisure activities occurred with the successive introduction of treatment across participants and that independent engagement occurred despite deficiencies in prerequisite skills and despite resorting to training those skills during the course of the main study, not in a preceding phase. Follow-up sessions held with two of the three participants demonstrated that performance maintained across time. A discussion of the findings and some of the limitations encountered in the present study, possibly beneficial to future research, will ensue.

During the few prebaseline sessions held in this study, there was an attempt to teach prerequisite skills necessary for independent engagement that were not in the participants' repertoires. As discussed earlier, however, given (a) the novelty of the structure and orientation imposed in the present study for the participants, (b) the language barriers (instruction at the participants' school was predominantly in French, not colloquial Lebanese as it was in research sessions), and, perhaps most critically, (c) the numerous deficiencies in the necessary prerequisite skills (from familiarity with a token economy to

Fig. 1 The percentage of independent-engagement components of the three participants completed correctly in the baseline, treatment, and follow-up (only Max and Alan) phases of the study. Breaks in the data are indicative of times when not all three participants had sessions on a given day, but rather a day or two apart depending on their availability

knowledge of activity completion and demonstration of matching skills), a less laborious and more efficient method was adopted in the present study to teach the necessary responses during the course of the main study. Therefore, the participants received DRO, response cost, and, to a lesser extent, verbal instructions to increase attending responses and decrease disruptive behavior. Transferring control from verbal instructions (the commonly used method of teaching in the participants' typical school day) to the individualized motivational system helped to associate research sessions with positive experiences to which the participants appeared to look forward. It also helped to reduce reliance on verbal instruction and prompts, thus avoiding dependence on the experimenter and minimizing the impact of the language barrier. Finally, all necessary prerequisite skills were successfully taught during baseline and treatment, as applicable or needed.

With respect to independent engagement, the implementation of treatment resulted in a systematic increase in the percentage of components completed correctly from baseline to treatment across participants. Furthermore, Max and Alan's performance was maintained for as long as 13 and 16 weeks after treatment, respectively.

The social validity measures obtained for the present study showed that independent engagement and social appropriateness were judged more favorably following treatment than in baseline. This was true even when considering a more conservative measure of social validity. Moreover, the scorers judged that the participants were making better use of their time during trials in treatment, and they were accurate in their designations of trials to the phases of the study. This was an important finding, especially that it included Ava's performance, which improved considerably—as the data showed

and as could be judged by experimentally naïve members of the community—despite never reaching criterion levels of performance. This was also important as it demonstrated that observers could accurately detect that the changes in behavior were indeed socially meaningful.

Several limitations are worth noting. First, the presentation of the activity schedule started only in treatment, and hence it was considered part of the independent variable. Adhering to the study of MacDuff et al. (1993), which presented the activity schedule across all phases, would have yielded a more robust experimental design in the present study. The rationale for instituting this diversion from MacDuff et al. (1993), however, was simple: Access to the participants in the present study was difficult and limited, thus the need to make the most of every session. It was anticipated that a baseline phase that replicated the baseline of MacDuff et al. (1993) would translate into having numerous sessions that last no more than a minute, with participants being asked to complete their work followed by a termination of the session given the lack of on-task and on-schedule performance. Therefore, a decision to make better use of baseline sessions was to the detriment of achieving stronger experimental control and ensuring consistency in the dependent measures across study phases. A future study might benefit from making good use of the time spent in baseline without sacrificing experimental robustness. This could be achieved by assigning a dual function to these sessions; one would be to carry out a baseline phase that is consistent with MacDuff et al. (1993), and, following a brief break within a given session, another function would be to teach necessary prerequisite skills. The break would ensure preservation of the integrity of the baseline phase. This would be akin to having research sessions embedded in a child's typical school day and undoubtedly surrounded by teaching opportunities, similar to those offering prerequisite-skill training in prebaseline research sessions. The difference here is that prebaseline sessions would be carried out in parallel to baseline sessions, not prior to them.

Second, and as alluded to above, because of the reliance on a school setting unaffiliated with this research, sessions were spaced out and short. Sessions could only be held on certain days of the week, after school hours, and they could not be held when schools were closed for holidays and vacations. It was also not possible to continue sessions with Ava after the school year had ended, although it was projected that her performance would have continued to improve. Moreover, restriction of behavioral intervention to the few, short research sessions meant that disruptive and perseverative behavior was practiced and reinforced (even if adventitiously) outside the boundaries of the sessions. This might have prolonged the acquisition of attending responses. A future study involving children with autism who do not have access to behavioral intervention outside the scope of the research might benefit from using a multiple-baseline design across settings or across

contingency managers, such that the other settings/managers would involve parents and/or teachers. Perhaps that way, generalization of effects would be more likely to occur to settings and stimuli beyond the research context, at least for attending behavior. This would serve not only conditions similar to those reported here but also the literature at large, as it is rare yet important, according to Koyama and Wang (2011), for parents to teach their children to use activity schedules.

Another limitation was that the present study obtained procedural integrity measures only on two sessions and did not obtain IOA on the few prebaseline sessions held before incorporating prerequisite-skill training into the main study. Although the reliability score obtained was very high (98.9 %) and despite the fact that protocol was followed in all other sessions as it was in those two, procedural integrity ought to have been assessed in more sessions. A main reason for this limitation in the present study was the shortage of ABA-trained therapists. It was less laborious to train observers to obtain IOA on the dependent measures. Nevertheless, it required more training than expected in research where primary and secondary observers are equally skilled at collecting behavioral data. Even though IOA scores were generally good in the present study, they had a poor lower limit.

In addition, it was noted that the participants ultimately learned to complete all but two activities. This information, however, was not properly documented because activity completion was viewed as an opportunity to assess on-task behavior and was not part of the dependent variable. Nevertheless, it would have been ideal to document such information.

Finally, although the present study contributed to the literature by assessing social validity, which is not typically assessed in studies concerned with activity schedules (Koyama and Wang 2011), the assessment was carried out with university students. Consistent with Koyama and Wang's (2011) recommendation, it would have been more meaningful to ask autism professionals and parents to rate the social validity of the intervention.

Despite these limitations and aside from this study's main achievement, a modest step achieved in the present study pertained to carrying out behavioral research in the first place. One way to put a cause on the map—be it for advocacy, awareness, or fundraising—is to conduct research. Advances in intervention stem from advances in research, and applied research is facilitated by the existence of intervention programs. The shortage of behavioral intervention programs in Lebanon brought about some meaningful findings, but it also brought about some obstacles.

Aside from the main contribution of teaching its participants to engage in leisure activities independently, the present study offered three critical contributions to counter those obstacles. First, it offered an effective alternative method to teaching target skills prior to the acquisition of prerequisite

skills. Adjustments such as this are often necessary in research contexts that are novel or constrained. This adjustment, in particular, added to the benefits of activity schedules.⁸ Second, it demonstrated that children with autism who do not attend behavioral intervention programs could benefit from behavioral procedures, even when those are delivered at an undesirably low pace. The point is not to encourage fewer intervention hours for those who have access to it but rather to show that even few intervention hours make a difference in the behavioral repertoire of their recipients and, anecdotally, in the attitudes of their caregivers and teachers. This speaks to the fact that behavior changes as a function of the contingencies in effect, even if there were competing contingencies across different settings. Third, the present study offered an introduction to a proper dissemination and delivery of ABA in a developing country that is prone to corruption and misuse of such forms of technology. Such an introduction requires a culture change. A shaping procedure would make it more tolerable and smooth. The present study was an initial step in that process. It also carried the added advantage of offering behavior-analytic services for the duration of an academic year free of charge to the participants and their caregivers, given its research context. This advantage is likely to be received well in contexts where caregivers are not familiar with the value of ABA in autism intervention and thus are unlikely to invest in it or cannot afford to pay the costs of the intervention, particularly in the absence of funding from local governments, which is likely the case in developing countries. A positive research outcome might pave the way to becoming interested in and informed of the benefits of ABA. This contribution is consistent with the model⁹ of the “innovation-decision process” developed by Rogers (2003). The model contains five stages—knowledge, persuasion, decision, implementation, and confirmation—the first three of which are relevant here.

First, the knowledge stage pertains to exposure to the existence of an innovation—behavioral intervention in this case—and its particulars (Rogers 2003). During its preparatory phases and following its completion, the present study served as a platform through which the researcher disseminated information that exposed autism professionals, parents, and students of psychology to behavioral intervention and attempted to correct previously acquired misconceptions about it. Second, persuasion pertains to whether a favorable or unfavorable attitude is developed toward the innovation, which may or may not prove to be advantageous to the individual. It is conceivable that the positive outcome obtained in this study demonstrated that properly executed

behavioral intervention leads target behavior to change in the desired direction. This in turn might have resulted in the formation of favorable attitudes toward ABA as effective in autism intervention. What makes this conclusion plausible is the fact that the school officials changed their behavior in a manner consistent with adopting the innovation, thus reaching Rogers’ (2003) decision stage. One change here pertained to recruiting the researcher to involve them in another study concerned with using ABA in autism intervention. Perhaps the present study served as a “trial period,” putting ABA to the test by “trying it on a probationary basis” (p. 177) before ultimately deciding that it is indeed advantageous to them.

Future research in places where behavioral intervention is scarcely available, and where governments fail to fund autism intervention could benefit those living with autism and their families by providing behavioral intervention in the context of research, while guarding against possible ethical violations (e.g., coercion). Research sessions should be intensified to the extent possible (e.g., a minimum of three 1-h sessions per week, preferably five 2-h sessions), and target responses ought to be prioritized, with priority to those responses that could easily transfer to the home setting and benefit the child in the largest scale possible. In such cases, research questions should try to address responses that are meaningful in the home setting and to “train loosely” (Baer 1999) to promote generalization and to facilitate handing over the behavioral program to the child’s parents (e.g., Koyama and Wang 2011; Krantz et al. 1993). Needless to say, ABA should be provided in autism intervention programs in Lebanon and other developing countries, as they are in developed countries. After all, intervention programs for autism do exist in developing countries such as Lebanon. The type of intervention provided, however, seems to be more diverse and inclusive when research, for decades, has been pointing to ABA as the intervention of choice for people with autism (e.g., Department of Health 1999; Department of Health and Human Services 1999; Gill 2001; Jacobson 2000; Rosenwasser and Axelrod 2001).

It is not uncommon for people with special needs living in developing countries to receive less than the ideal form of treatment (e.g., Divan et al. 2012; Mirza et al. 2009) or to bear the brunt of corruption (e.g., pseudo-professionals presenting themselves as ABA therapists), reinforced by lax or nonexistent government-based policies and checks and by the brain-drain phenomenon that typically impacts developing countries whereby highly skilled and competent individuals emigrate (e.g., Anas and Wickremasinghe 2010; Chaaban 2009). It remains, nonetheless, a harsh reality for those living with autism and for their parents. A solution to a minor element in this problem was attempted in the present study, whereby using activity schedules to promote independent engagement, an important skill pioneered by behavior analysts (MacDuff et al. 1993; McClannahan and Krantz 2010) and transformed

⁸ Thanks are due to an anonymous reviewer for pointing out the significance of this contribution.

⁹ Thanks are due to an anonymous reviewer for suggesting that this model be adopted here.

into a lifestyle for people with autism (Fenske and MacDuff 2011), not only taught children with autism to be self-reliant but also became a vehicle to introduce ABA to children not otherwise benefitting from its methods. This introduction served two purposes and provided insights into a third. First, it made possible a modified replication of the landmark study of MacDuff et al. (1993). Second, it identified how a minimalist approach could be used to achieve a solid behavioral outcome despite having taught the least prerequisite skills necessary during the course of the main study. Finally, falling within Rogers' (2003) decision stage—just one step before the implementation stage—it demonstrated that a behavioral study could succeed with children not receiving intensive—or any—behavioral intervention, thus finding a way to provide the top empirically validated and federally recommended interventions to children with autism not otherwise privy to it, albeit at a small scale.

Acknowledgments This research was funded in part by a grant from the University Research Board at the American University of Beirut. I am indebted to Mrs. Arwa El-Amine Halawi for generously securing the premises on which the study was conducted, to the children and their families for their participation and interest, and to Dr. Nadiya Slobodenyuk and Theresa Fiani for reviewing an earlier version of the manuscript. I am also very grateful for the students and colleagues who expressed an interest in this study, especially for those who obtained interobserver-agreement data and for Rita Obeid who obtained procedural-reliability data as well. Last but not least, I owe special, heartfelt thanks to Roger Daou for his great support throughout this project.

Conflict of Interest The author declares that she has no conflict of interest.

References

- Anas, M. U. M., & Wickremasinghe, S. I. (2010). Brain drain of the scientific community of developing countries: the case of Sri Lanka. *Science and Public Policy*, 37, 381–388. doi:10.3152/030234210X501199.
- Axe, J. B., & Sainato, D. M. (2010). Matrix training of preliterate skills with preschoolers with autism. *Journal of Applied Behavior Analysis*, 43, 635–652. doi:10.1901/jaba.2010.43-635.
- Baer, D. M. (1999). How to plan for generalization (2nd Ed.). In R. V. Hall & M. L. Hall (Series Eds.), *How to Manage Behavior Series*. Austin, TX: Pro-Ed.
- Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, 1, 91–98. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Banda, D. R., & Grimmer, E. (2008). Enhancing social and transition behaviors of persons with autism through activity schedules: a review. *Education and Training in Developmental Disabilities*, 43(3), 324–333.
- Betz, A., Higbee, T. S., & Reagon, K. A. (2008). Using joint activity schedules to promote peer engagement in preschoolers with autism. *Journal of Applied Behavior Analysis*, 41, 237–241. doi:10.1901/jaba.2008.41-237.
- Blum-Dimaya, A., Reeve, S. A., Reeve, K. F., & Hoch, H. (2010). Teaching children with autism to play a video game using activity schedules and game-embedded simultaneous video modeling. *Education and Treatment of Children*, 33, 351–370. <http://www.educationandtreatmentofchildren.net/index.html>.
- Bryan, L. C., & Gast, D. L. (2000). Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules. *Journal of Autism and Developmental Disorders*, 30, 553–567. Retrieved from <http://www.springerlink.com/content/104757/>.
- Buffington, D. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1998). Procedures for teaching appropriate gestural communication skills to children with autism. *Journal of Autism and Developmental Disorders*, 28, 535–545. <http://www.springerlink.com/content/104757/>.
- Cassella, M. D., Sidener, T. M., Sidener, D. W., & Progar, P. R. (2011). Response interruption and redirection for vocal stereotypy in children with autism: a systematic replication. *Journal of Applied Behavior Analysis*, 44, 169–173. doi:10.1901/jaba.2011.44-169.
- Chaaban, J. (2009). Public sector can reduce push factors that drive youth emigration. In R. G. Khouri (Chair), *Youth in the Arab World*. Symposium conducted at the meeting of the Issam Fares Institute for Public Policy and International Affairs, American University of Beirut, Beirut, Lebanon.
- Charania, S. M., LeBlanc, L. A., Sabanathan, N., Ktaech, I. A., Carr, J. E., & Gunby, K. (2010). Teaching effective hand raising to children with autism during group instruction. *Journal of Applied Behavior Analysis*, 43, 493–497. doi:10.1901/jaba.2010.43-493.
- Department of Health. (1999). *Clinical practice guideline for autism/pervasive developmental disorders: assessment and intervention for young children (age 0-3 years)*. Albany, NY: Early Intervention Program, New York State Department of Health.
- Department of Health and Human Services. (1999). *Mental health: a report of the surgeon general*. Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health.
- Divan, G., Vajaratkar, V., Desai, M. U., Strik-Lievers, L., & Patel, V. (2012). Challenges, coping strategies, and unmet needs of families with a child with autism spectrum disorder in Goa, India. *Autism Research*, 5, 190–200. doi:10.1002/aur.1225.
- Fenske, E. C., & MacDuff, G. S. (2011). *Technology and teaching go hand-in-hand* (Report No. 20.1). Retrieved from Princeton Child Development Institute website: http://www.pcdi.org/images/PCDI_Newsletter_Oct2011.pdf.
- Geiger, K. B., Carr, J. E., LeBlanc, L. A., Hanney, N. M., Polick, A. S., & Heinicke, M. R. (2012). Teaching receptive discriminations to children with autism: a comparison of traditional and embedded discrete trial teaching. *Behavior Analysis in Practice*, 5, 49–59. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- Gill, A. R. (2001). Interventions for autism. *The Journal of the American Medical Association*, 286, 670–671. <http://jama.jamanetwork.com/journal.aspx>.
- Green, G. (2001). Behavior analytic instruction for learners with autism: advances in stimulus control technology. *Focus on Autism and Other Developmental Disabilities*, 16, 72–85. <http://foa.sagepub.com/content/current>.
- Hoch, H., Taylor, B. A., & Rodriguez, A. (2009). Teaching teenagers with autism to answer cell phones and seek assistance when lost. *Behavior Analysis in Practice*, 2, 14–20. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- Ingvarsson, E. T., & Hollobaugh, T. (2011). A comparison of prompting tactics to establish intraverbals in children with autism. *Journal of Applied Behavior Analysis*, 44, 659–664. doi:10.1901/jaba.2011.44-659.
- International Monetary Fund. (2012). *World economic outlook: growth resuming, dangers remain*. <http://www.imf.org/external/pubs/ft/weo/2012/01/pdf/text.pdf>.

- Jacobson, J. W. (2000). Converting to a behavior analysis format for autism services: decision-making for educational administrators, principals, and consultants. *The Behavior Analyst Today*, 1, 6–16. <http://www.baojournal.com/>.
- Kliebert, M. L., Tiger, J. H., & Toussaint, K. A. (2011). An approach to identifying the conditions under which response interruption will reduce automatically reinforced problem behavior. *Behavior Analysis in Practice*, 4, 17–26. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- Koyama, T., & Wang, H. T. (2011). Use of activity schedule to promote independent performance of individuals with autism and other intellectual disabilities: a review. *Research in Developmental Disabilities*, 32, 2235–2242. doi:10.1016/j.ridd.2011.05.003.
- Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to initiate to peers: effects of a script-fading procedure. *Journal of Applied Behavior Analysis*, 26, 121–132. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Krantz, P. J., & McClannahan, L. E. (1998). Social interaction skills for children with autism: a script-fading procedure for beginning readers. *Journal of Applied Behavior Analysis*, 31, 191–202. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Krantz, P. J., MacDuff, M. T., & McClannahan, L. E. (1993). Programming participation in family activities for children with autism: parents' use of photographic activity schedules. *Journal of Applied Behavior Analysis*, 26, 137–138. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Libby, M. E., Weiss, J. S., Bancroft, S., & Ahearn, W. H. (2008). A comparison of most-to-least and least-to-most prompting on the acquisition of solitary play skills. *Behavior Analysis in Practice*, 1, 37–43. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology*, 55, 3–9. doi:10.1037/0022-006X.55.1.3.
- MacDonald, R., Green, G., Mansfield, R., Geckeler, A., Gardenier, N., Anderson, J., Holcomb, W., & Sanchez, J. (2007). Stereotypy in young children with autism and typically developing children. *Research in Developmental Disabilities*, 28, 266–277. doi:10.1016/j.ridd.2006.01.004.
- MacDuff, G. S., Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to use photographic activity schedules: maintenance and generalization of complex response chains. *Journal of Applied Behavior Analysis*, 26, 89–97. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Machalicek, W., Shogren, K., Lang, R., Rispoli, M., O'Reilly, M. F., Franco, J. H., & Sigafoos, J. (2009). Increasing play and decreasing the challenging behavior of children with autism during recess with activity schedules and task correspondence training. *Research in Autism Spectrum Disorders*, 3, 547–555. doi:10.1016/j.rasd.2008.11.003.
- McClannahan, L. E., & Krantz, P. J. (2010). *Activity schedules for children with autism: teaching independent behavior* (2nd ed.). Bethesda, MD: Woodbine House.
- Miguel, C. F., Yang, H. G., Finn, H. E., & Ahearn, W. H. (2009). Establishing derived textual control in activity schedules with children autism. *Journal of Applied Behavior Analysis*, 42, 703–709. doi:10.1901/jaba.2009.42-703.
- Mirza, I., Tareen, A., Davidson, L. L., & Rahman, A. (2009). Community management of intellectual disabilities in Pakistan: a mixed methods study. *Journal of Intellectual Disability Research*, 53, 559–570. doi:10.1111/j.1365-2788.2009.01176.x.
- Morrison, H., Roscoe, E. M., & Atwell, A. (2011). An evaluation of antecedent exercise on behavior maintained by automatic reinforcement using a three-component multiple schedule. *Journal of Applied Behavior Analysis*, 44, 523–541. doi:10.1901/jaba.2011.44-523.
- Parsons, M. B., Reid, D. H., Bentley, E., Inman, A., & Lattimore, L. P. (2012). Identifying indices of happiness and unhappiness among adults with autism: potential targets for behavioral assessment and intervention. *Behavior Analysis in Practice*, 5, 15–25. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- Petersdottir, A. L., McComas, J., McMaster, K., & Horner, K. (2007). The effects of scripted peer tutoring and programming common stimuli on social interactions of a student with autism spectrum disorder. *Journal of Applied Behavior Analysis*, 40, 353–357. doi:10.1901/jaba.2007.160-05.
- Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis*, 40, 123–136. doi:10.1901/jaba.2007.11-05.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.
- Rosenwasser, B., & Axelrod, S. (2001). The contributions of applied behavior analysis to the education of people with autism. *Behavior Modification*, 25, 671–677. <http://online.sagepub.com/>.
- Sidman, M. (2011). Can an understanding of basic research facilitate the effectiveness of practitioners? Reflections and personal perspectives. *Journal of Applied Behavior Analysis*, 44, 973–991. doi:10.1901/jaba.2011.44-973.
- Tarbox, R. S. F., Tarbox, J., Ghezzi, P. M., Wallace, M. D., & Yoo, J. H. (2007). The effects of blocking mouthing of leisure items on their effectiveness as reinforcers. *Journal of Applied Behavior Analysis*, 40, 761–765. doi:10.1901/jaba.2007.761-765.
- Taylor, B. A., & Hoch, H. (2008). Teaching children with autism to respond to and initiate bids for joint attention. *Journal of Applied Behavior Analysis*, 41, 377–391. doi:10.1901/jaba.2008.41-377.
- Taylor, B. A., & Levin, L. (1998). Teaching a student with autism to make verbal initiations: effects of a tactile prompt. *Journal of Applied Behavior Analysis*, 31, 651–654. <http://seab.envmed.rochester.edu/jaba/index.html>.
- Ulke-Kurkcuoglu, B., & Kircaali-Iftar, G. (2010). A comparison of the effects of providing activity and material choice to children with autism spectrum disorders. *Journal of Applied Behavior Analysis*, 43, 717–721. doi:10.1901/jaba.2010.43-717.
- Walsh, M. B. (2011). The top 10 reasons children with autism deserve ABA. *Behavior Analysis in Practice*, 4, 72–79. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.
- White, E. R., Hoffmann, B., Hoch, H., & Taylor, B. A. (2011). Teaching teamwork to adolescents with autism: the cooperative use of activity schedules. *Behavior Analysis in Practice*, 4, 27–35. <http://www.ncbi.nlm.nih.gov/pmc/journals/1182/>.