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Disseminating ASD Interventions: A Pilot Study of a Distance Learning Program for Parents and Professionals

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Abstract There is a need for the adaptation of training in evidence-based interventions to non-traditional methods, particularly for individuals working with children with autism spectrum disorders (ASD). An internet-based self-directed distance learning program was created to teach reciprocal imitation training, a naturalistic behavioral intervention aimed at increasing imitation in children with ASD. A single-subject multiple-baseline design study evaluated the effect of the program on changes in therapist (sample 1) and parent (sample 2) knowledge and behavior, and changes in child behavior. Adult participants improved their knowledge and use of the intervention techniques, and child participants improved their rates of imitation. Results suggest that a self-directed distance learning program may be effective for disseminating evidence-based practices to individuals working with children with ASD.

Keywords Autism spectrum disorders · Parent training · Distance learning · Internet-based training · Intervention

Introduction

Recent epidemiological reports suggest that the number of children diagnosed with autism spectrum disorders (ASD) is rising, with as many as 1 out of every 110 children receiving this diagnosis (Centers for Disease Control and Prevention 2009). However, there has not been a corresponding growth in the dissemination of evidenced-based interventions for children with ASD. This, in turn, has engendered a service-need discrepancy for children with ASD and their families (Sperry et al. 1999; Stahmer and Gist 2001). Furthermore, recommendations from the National Research Council (NRC) state that children with autism should receive specialized services for at least 25 h a week, 12 months per year (NRC 2001). Given this population's need for intensive intervention and the growing number of children requiring such services, an expansion in the availability of, and access to, evidence-based treatments is essential.

The National Research Council's (2001) report on educating children with autism concluded that many individuals working with children with ASD do not receive sufficient instruction in evidence-based intervention techniques. Barriers associated with training and implementing evidence-based intervention techniques, including those grounded in ABA, include limited monetary resources, significant time demands, and problems with the portability of intervention from the research laboratory to existing clinical settings (Harvey et al. 2010; Kazdin 2008). As such, it is necessary to consider training models in which these barriers can be overcome in time- and cost-effective ways.

Distance Learning Programs

The use of computer and internet technology can help address, and surmount, many of the challenges associated with traditional training models by granting remote access to evidence-based practices (Scheuermann et al. 2003; Symon 2001). As of 2007, 71 % of US households had access to the internet and nearly 83 % of adults were able to access the internet from home, work, or elsewhere (US

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Census Bureau 2009). Distance learning programs allow for instruction in evidence-based intervention to be accessed from anywhere at any time, while sustaining standardized instruction and maintaining fidelity of program implementation (Hollon et al. 2002; Mandel et al. 1998). Training via computers and the internet allows for direct interaction with instructional content; hypothetical situations, vignettes and practice exercises can be transformed into rich media forms such as video or animation which then can be used to develop and test participant knowledge (Weingardt 2004).

Distance Learning Programs for ASD Providers

Initial research has indicated that distance learning programs are an effective means for disseminating knowledge to various populations (Hollon et al. 2002). Computer and internet-delivered programs have been utilized to train professionals in a variety of health-related settings, including those who work with individuals with ASD (e.g., Benjamin et al. 2008; Granpeesheh et al. 2010; Hamad et al. 2010). Hamad et al. (2010) trained 51 professionals, paraprofessionals, and family members in principles and procedures of applied behavior analysis (ABA) using an online distance-learning course that included narrated slide presentations, video examples, and application exercises. Participants made statistically significant gains in intervention knowledge from pre- to post-training and reported a high level of satisfaction with the course (Hamad et al. 2010). Similarly, Granpeesheh et al. (2010) compared the effectiveness of an eLearning program to teach 33 therapists, with that of traditional live didactic training to teach 55 therapists ABA principles. Participants in both training groups significantly increased their knowledge about ABA principles and procedures; however, those in the traditional training group demonstrated slightly more gains than those in the eLearning condition (Granpeesheh et al. 2010). These data suggest that self-directed instruction may be an effective method for increasing providers' intervention knowledge. However, it is unclear how these knowledge gains would translate to the ability to correctly implement the ABA techniques.

Vismara et al. (2009) assessed the effectiveness of a DVD-delivered training program for community-based therapists working with children with autism. Ten community-based therapists utilized the self-directed DVD-based training program, and then received an additional 13 h of didactic instruction and 4 h of team supervision. After using the self-directed DVD, therapists' implementation of intervention techniques improved significantly, suggesting the potential for success of this type of education delivery model. However, the majority of participants required didactic instruction and team supervision from a

professional in order to achieve fidelity of implementation of the intervention techniques, suggesting that expert coaching and support may be necessary for individuals to implement autism intervention with fidelity (Vismara et al. 2009).

Parent Training for Families of Children with ASD

Although the use of distance learning programs can increase service providers' access to training in evidence-based intervention techniques, this is not necessarily sufficient to ensure that children with ASD will be provided with enough access to evidence-based intervention. As such, it is critical to consider training other key individuals, such as parents, in evidence-based intervention techniques (Scheuermann et al. 2003). Parent training is an especially cost-effective and ecologically valid way to bolster the amount of intervention a child receives. With respect to ASD, parent training and family involvement in intervention has been cited as a fundamental component of effective intervention programs (NRC 2001). A significant body of literature suggests that parents can be successfully trained in techniques to improve the social communication skills in children with ASD (e.g., Koegel et al. 1996; Rogers et al. 2006; Ingersoll and Gergans 2007; Drew et al. 2002). Additional benefits of parent training include increases in generalization and maintenance of child skill, a reduction in parent stress, and increases in family leisure time (Koegel et al. 1982, 1996).

However, there are significant barriers associated with accessing parent training programs via clinic-based service delivery models. Limited financial resources, limited transportation, lack of child care, geographic isolation, lengthy waitlists, and extensive time commitments have all been cited as obstacles to participation in traditional parent training programs (Stahmer and Gist 2001; Symon 2001). As such, there is an identified need for the adaptation of parent training in evidence-based interventions to non-traditional service delivery models (Feil et al. 2008).

Distance Learning Programs for Parents of Children with ASD

Distance learning may provide one avenue for surmounting these barriers. Several studies of distance learning programs for teaching behavior management strategies and general adaptive parenting techniques to high risk parents and those with children at risk for disruptive behavior have shown promise (e.g., Baggett et al. 2010; Feil et al. 2008; Kacir and Gordon 1999; MacKenzie and Hilgedick 1999; Taylor et al. 2008; Webster-Stratton et al. 1989), suggesting the potential for this approach. However, there is limited research empirically

evaluating the use of distance learning programs to teach intervention strategies to parents of children with ASD. To date, only one published study has empirically evaluated the efficacy of a self-directed distance learning program for parents of children with autism. Nefdt et al. (2010) used a DVD-based self-directed distance learning program to introduce 27 primary caregivers of children with ASD to pivotal response training (PRT), an evidence-based naturalistic behavioral intervention, to increase their child's verbal language (Nefdt et al. 2010). The program consisted of 14 training modules presented via DVD with an accompanying paper-based parent manual. Information was presented via text and audio lecture and short video examples of each technique were provided. Participants completed short quizzes to check for comprehension at the conclusion of each module. At the conclusion of the program, the caregivers participated in an interactive learning task where they assessed others' ability to implement PRT techniques. Results of this small scale randomized control trial indicated that caregivers were willing to complete such a program. Moreover, participants in the treatment group (n = 13) showed significantly more improvement in their ability to implement PRT techniques, provided significantly more language opportunities for their children, and displayed significantly greater confidence when interacting with their children, than did participants in the control group (n = 14). Additionally, at post-treatment, children in the treatment group used significantly more functional verbal utterances than did those in the control group (Nefdt et al. 2010). This study suggests that both caregivers and their young children with autism were able to benefit from participation in a self-directed, distance learning program without support and guidance from professional coaches.

The work done by Nefdt and colleagues is some of the first to suggest that techniques from an evidence-based skill-building intervention for young children with autism can be successfully adapted into a computerized parent training program. The study utilized a pre-recorded DVD to deliver instruction; alternatively, the use of an internet-based delivery system for parent training has promising implications, especially with regards to keeping instruction systematic yet individualized. Moreover, use of the internet allows parents to have immediate remote interactions with the instructional content, coaches, and other parents. The internet also allows parents' use of the online program to be tracked, which can help ensure study standardization and offer insight into the way in which parents use these types of programs. By tracking participant use, important information about how parents approach such programs, such as completing the program all at once versus stretching it out over days and weeks, can be acquired.

Summary

In summary, there is insufficient access to training in evidence-based intervention techniques for providers and parents of children with ASD. An examination of previous research suggests that distance learning programs have the potential to surmount many of the barriers associated with traditional intervention training models. However, to date, the empirical literature examining such programs for parents and providers working with children with ASD is limited.

Purpose of this Research

The purpose of this research is to evaluate the initial efficacy of a self-directed, internet-based, distance learning program for teaching evidence-based intervention techniques for children with ASD. The intervention used in this research, reciprocal imitation training (RIT), is a naturalistic behavioral intervention that has been found to be efficacious for increasing spontaneous imitation skills in young children with ASD (Ingersoll 2010; Ingersoll et al. 2007; Ingersoll and Schreibman 2006). Previous research has indicated that both undergraduate therapists and parents can learn to effectively implement RIT when trained by expert therapists in a lab setting (Ingersoll 2010; Ingersoll and Gergans 2007). Notably, the training in these studies involved one-on-one coaching and direct feedback from an expert trainer over the course of several weeks. It is not yet clear if such intensive support and feedback are necessary for parents to learn RIT techniques.

The use, feasibility, and efficacy of the internet-based training program were first examined with a sample of undergraduate research assistants who were training as therapists for an intervention study. The use, feasibility, and efficacy of this program were also evaluated in a second sample of parents of young children with ASD. The goal of this research was to assess the degree to which therapists-in-training and parents could learn and implement RIT after engaging in a self-directed, internet-based training program. Additional goals of this study were to assess the impact of the training on child imitation skills, and to evaluate the acceptability of this training approach to parents.

Method

Participants

Sample 1

Participants in this sample were six female undergraduate students at a large mid-western university. These

therapists-in-training[1] were new research assistants in a laboratory specializing in the study of autism interventions. All of the therapists had previous experience working with children; only three, Kim, Becky, and Natalie, had experience with individuals with ASD. None of the therapists had been formally trained in any autism intervention techniques, nor exposed to any video or live-demonstrations of RIT, prior to beginning this program.

Five young children with ASD were recruited to interact with the therapists before and after training to examine the therapists' ability to implement the intervention with a child. All children had been previously involved in studies in the research lab and met DSM-IV criteria for autism as well as the cutoff for autism spectrum disorder on the Autism Diagnostic Observation Schedule (Lord et al. 2002). Additionally, their parents completed the Developmental Profile-3 (DP-3; Alpern 2007) to provide an estimate of their cognitive and communication age and the Social Responsiveness Scale (SRS; Constantino et al. 2003) to obtain a measure of autism severity.

Sample 2

The second sample consistent of three young children with ASD and their mothers. The children were all diagnosed by a professional using DSM-IV criteria. At intake, parents completed the Social Communication Questionnaire (SCQ; Berument et al. 1999; Rutter et al. 2003) to obtain a measure of autism severity and the DP-3 (Alpern 2007) to assess child developmental level. Parents completed the Parenting Stress Index-Short Form (PSI-SF; Abidin 1995) to evaluate current parenting stress, with the thought that increased levels of stress may have an impact on learning (Robbins et al. 1991). Parents who had received prior training in naturalistic behavioral intervention techniques were excluded from participation. See Table 1 for participant information.

Jonathan lived with his mother, father, and younger brother who was also suspected of having ASD. Jonathan's mother, Jamie, had a graduate degree and worked in the mental health field. Jamie's score on the PSI-SF was 106, suggesting clinically elevated levels of stress at intake. She had previously received training in relationship development intervention (RDI; Gutstein and Sheely 2002), a developmental intervention for children with ASD.

Rick lived with his mother and father. Rick and his family moved to the US when he was 3 years old. Although both the language of origin and English were spoken in the home, all of Rick's education and intervention work was in English. Rick's mother, Jill, had a graduate degree and was currently staying at home to raise Rick. Jill received a score of 117 on the PSI-SF, suggesting clinically elevated levels of stress at intake. Two years prior to participation in the current study, Jill had participated in a 3-month intensive parent training program in structured ABA techniques through an area autism center.

Gary lived with his mother and father. Gary's mother, Tina, had attended some college and worked as an executive assistant. Tina's score on the PSI-SF was 64, indicating that her stress levels were within the normal range during intake. Tina had not received any parent training prior to participation in the current study.

Settings and Materials

Therapists completed the online training program on computers in their homes or in the research lab. Parents completed the online training program on their own home computers. All therapist baseline and post-training sessions were conducted and recorded in a treatment room at the research lab, while all parent baseline and post-training sessions were conducted in the participants' homes. Five pairs of developmentally-appropriate toys from the research lab were provided for each session.

Training Program

Program Delivery Platform

The program was delivered via a course management software program widely used by universities in the United States. Participants were assigned a username and password for access to the course.

Program Structure

The program introduced individuals to RIT, an evidence-based intervention to increase imitation in children with ASD (e.g., Ingersoll 2010). A PDF of the training manual, which provided written descriptions of the techniques and suggestions for how to utilize them during RIT, was available for participants to view and print. It was adapted from the manual developed for training parents in RIT (Ingersoll and Gergans 2007). See Table 2 for an explanation of the training modules, instructional content, and learning components.

Instructional content was presented in the order described in Table 2 because a familiarity with, and understanding of the earlier content is crucial for the implementation of the later content. As such, parent participants were instructed to practice the techniques from a

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[1] Because the undergraduate participants had not received prior training, they were called therapists-in-training. However, for clarity and easy of communication, they will be referred to as "therapists" throughout the remainder of the text.

Table 1 Child participant characteristics

Child	DP-3 chronological age (months)	DP-3 cognitive age (months)	Communication age (months)	Autism SRS	Severity SCQ
Sample 1					
Jake	66	29	20	92	
Tim	35	29	18	56	
Andy	66	29	26	81	
Zak	40	34	22	79	
Dean	74	41	46	60	
Sample 2					
Jonathan	69	16	6		22
Rick	88	47	26		34
Gary	26	24	16		8[a]

DP-3 Developmental Profile-3. *SRS* Social Responsiveness Scale; ≥ 60 consistent with ASD diagnosis; ≥ 76 consistent with autism diagnosis. *SCQ* Social Communication Questionnaire; ≥ 15 consistent with ASD diagnosis

[a] This score was below cutoff for suspected ASD. The developers of this instrument suggest caution when the SCQ with children under 4 years. Gary was also administered Module One of the ADOS (Lord et al. 2002), on which he was above the cutoff for an autism spectrum disorder

Table 2 Program Structure

Program module	Instructional content	Learning components
Module 1: Introduction to reciprocal imitation training	Presents an overview of RIT and imitation, provides background information about naturalistic behavioral intervention, and offers rationale for training in evidence-based techniques.	PowerPoint with audio lecture, Video example of a child before and after intervention, Quiz
Module 2: Setting up the home for success	Introduces ways to limit environmental distractions and prepare for a successful RIT session.	PowerPoint with audio lecture, Quiz
Module 3: Contingent imitation	Introduces *contingent imitation*. The adult imitates the child's verbal and nonverbal behavior to promote reciprocity.	PowerPoint with audio lecture, Video examples of *contingent imitation*, Interactive Learning Task, Quiz
Module 4: Linguistic mapping	Introduces *linguistic mapping*. The adult uses simple and repetitive language around the child's focus of attention to provide a rich language environment.	PowerPoint with audio lecture, Video examples of *linguistic mapping*, Interactive Learning Task, Quiz
Module 5: Teaching object imitation	Introduces the steps for *teaching object imitation*. The adult models an action with an object once a minute. Actions are modeled up to three times and paired with a distinct verbal marker describing the play action. If the child does not imitation within 10 s of the third model, the adult physically prompts the child to complete the action. The adult provides praise for imitation.	PowerPoint with audio lecture, Video examples of *teaching object imitation*, Video examples of *RIT sessions*, Interactive Learning Task, Quiz

specific module before moving on (therapists-in-training did not have access to children to practice with during the self-directed training period and were thus simply asked to complete the modules in order). The first four modules took between 4 and 12 min to view, while the final module, *teaching object imitation*, took approximately 40 min to view.

Participants were asked to complete short quizzes to assess their comprehension of the instructional content. Additionally, they engaged in short interactive learning tasks, which required them to judge short clips of adult-child interactions for accurate use of RIT techniques. They were provided with immediate feedback on the quizzes and the interactive learning tasks. The participants were able to move on to the next training module regardless of performance on these tasks and were able to revisit earlier modules at any point during the program.

Experimental Design and Procedure

An IRB approved single-subject, multiple-baseline design was conducted across therapist-child and parent–child dyads (Hersen and Barlow 1976). Because only five children were available in the first sample, one child interacted

with two therapists. Dyads were randomly assigned to different pre-determined baseline periods (Edgington 1996). After baseline sessions, participants completed the program. Participants were then filmed implementing RIT with the children. The amount of time between the final baseline session and first post-training session was 19–40 days ($M = 29$ days) for therapists and 23–36 days ($M = 30$ days) for parents.

Baseline

During the 10-min baseline sessions, participants were asked to play with the child in the same way they usually would.

Training

Participants were asked to work through the online training program over the subsequent 2 weeks. They were asked to complete each of the training modules with the corresponding comprehension checks and interactive learning tasks.

Post-Training

Sample 1 During post-training, therapists were filmed implementing three, 10-min RIT sessions in the lab. If the therapist was unable to achieve fidelity of implementation after the third session, 30 min of live demonstration and instruction from an expert coach in the lab setting was provided. After coaching, therapists were filmed for two additional sessions.

Sample 2 During post-training, parents were filmed implementing two 10-min RIT sessions in their homes. If the parent was unable to achieve fidelity of implementation after the second post-training session, 30 min of live demonstration and instruction from an expert coach was provided in the home. After the in-person coaching session, parents were filmed implementing RIT for an additional 10-min session. Parents also completed a treatment acceptability questionnaire to assess program utility and parent satisfaction with the intervention.

Dependent Measures

Program Utilization

Frequency and duration of therapist utilization of the internet-based training program was tracked on the webserver.

Knowledge of RIT

Participant knowledge of RIT and naturalistic behavioral intervention techniques was assessed with a brief online multiple choice exam and an interactive learning task. Participants completed the same knowledge quiz and interactive learning task before beginning the first training module and upon completion of the final training module.

Fidelity of Implementation of RIT

To evaluate correct implementation of RIT, two trained observers scored the therapist-child interactions for fidelity. Observers rated the participants from one (poor implementation) to five (excellent implementation) on contingent imitation, linguistic mapping, and teaching object imitation (including modeled actions, prompting and

Table 3 Behavioral definitions		
RIT components	
Contingent imitation	Following the child's lead and imitating the child's actions with toys, as well as imitating the child's gestures/body movements and vocalizations
Linguistic mapping	The use of simple, repetitive language around the child's focus of attention to describe objects and action
Imitation training	The correct use of all three imitation training strategies within a single trial
Modeling actions	Modeling an action and descriptive verbal marker with a toy related to the child's play
Prompting	Using physical guidance, a verbal command, or gesture to encourage the child to imitate the modeled action if the child does not spontaneously imitate after the third model
Reinforcement	Providing the child with praise and continued access to the toys after both spontaneous and prompted imitation
Child behavior	
Imitation	The child imitates the adult's model of an action with a toy or a gesture within 10-s of the model. The imitation may be spontaneous or completed with the assistance of a verbal command, gestural prompt, or physical prompt

praise) using an RIT fidelity form (Ingersoll and Lalonde 2010). An average rating of 4 or above (80 %) was considered implementing the intervention with fidelity. See Table 3 for behavioral definitions.

Child Imitation

The majority of research demonstrating that RIT is effective for developing imitation skills has involved consistent implementation of the intervention over several months (e.g., Ingersoll 2010). To evaluate changes in child imitation performance during this brief intervention, rate per minute of imitation (spontaneous and prompted) was calculated by dividing the number of imitations by the number of minutes of the session. See Table 3 for behavioral definitions.

Treatment Acceptability

Parent participants were also asked to complete a modified version of the *Behavioral Intervention Rating Scale* (BIRS; Elliott and Treuting 1991) at post-treatment to evaluate the feasibility, acceptability, and effectiveness of the service-delivery model and intervention program. The BIRS is a well-validated measure that asks individuals to endorse items that assess the acceptability of a treatment's procedures as well as the treatment's perceived effectiveness on a 6-point scale, ranging from one (strongly disagree) to three (neutral) to six (strongly agree). For the purposes of this study, the BIRS was modified to better reflect the goals of the current intervention (i.e., acquisition of imitation skills). Parents were also asked to rate three additional items that assessed the usability of the program using the same rating scale as the BIRS (See Table 4 for additional items). Lastly, parents were asked to indicate benefits and limitations of the intervention in an open-ended format.

Inter-Observer Reliability

Inter-observer reliability was obtained for 25 % of the observational measures by trained research assistants. Pearson's r was used to calculate reliability for fidelity of

implementation (.94–.99) and for child imitation rate (.98–.99). Follow-up t-tests indicated no significant differences between raters for any of the measures (Hartmann 1977).

Results

Program Utilization

The amount of time between initial access to the program and completion of the post-training assessments ranged from 5 to 36 days ($M = 14$ days) for therapists, and from 1 to 46 days ($M = 22$ days) for parents. During this time, the therapists logged on to the program between 4 and 12 different times ($M = 8$), while parents logged on between 2 and 13 different times ($M = 9$). All participants viewed the training modules in the correct order.

Knowledge of RIT

Wilcoxon Signed Rank tests were conducted to test for significant differences in participant scores on the RIT knowledge quiz and interactive learning tasks from pre- to post-training for the full sample. Results indicated that the participants did significantly better on the RIT knowledge quiz at post-training ($M = 89.44$ %, SD = 7.26 %) than they did at pre-training ($M = 68.89$ %, SD = 12.44 %), $Z = -2.67$, $p < .05$. There was an improvement in participant scores on the interactive learning task from pre-training ($M = 75.55$ %, SD = 12.85 %) to post-training ($M = 89.44$ %, SD = 7.26 %); however, this difference was not significant, $Z = -1.72$, *n.s.*

### Fidelity of Implementation of RIT

Sample 1

All therapists improved their implementation of RIT techniques from baseline to post-training (see Fig. 1). Kim, Becky, and Erin were able to implement RIT techniques with fidelity after using the internet-based training program alone. The child initially paired with Natalie experienced

Table 4 Average treatment acceptability ratings by BIRS scale	

Scales	Mean (range)
Program acceptability (12 items)	6.00 (6.00–6.00)
Program effectiveness (8 items)	5.38 (4.00–6.00)
Program usability (3 items, see below)	6.00 (6.00–6.00)
The online format of the program was appropriate for learning the intervention strategies	
The amount of training and support received was sufficient for me to learn the intervention strategies	
The parent training materials were easy to understand	

1 = strongly disagree, 3 = neutral, 6 = strongly agree

Fig. 1 Fidelity of implementation for sample 1 (therapists). *Sessions 5–7 were conducted with Andy, sessions 8–10 were conducted with Zak
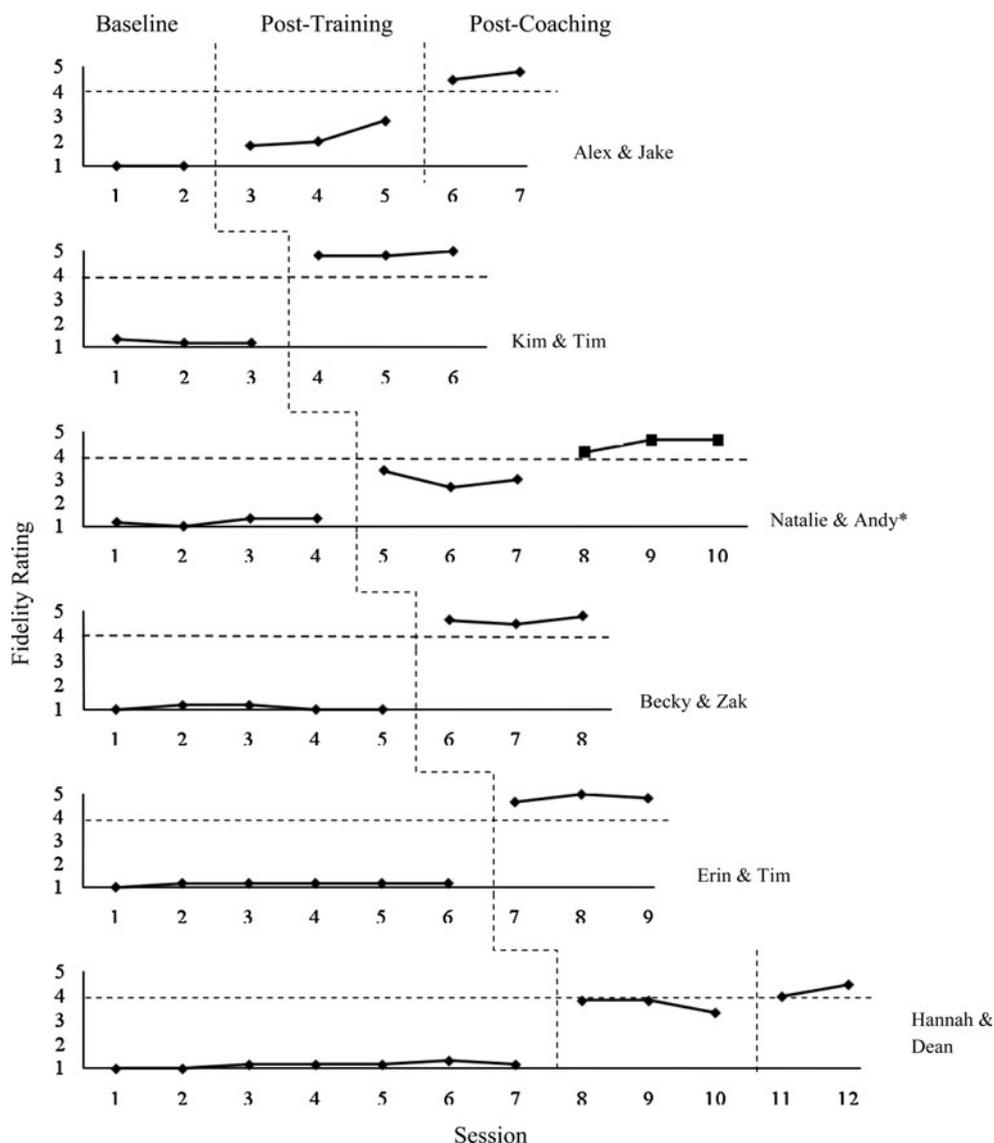
significant disruptions to his routine and subsequent behavioral issues over the course of training, particularly during the post-training sessions (sessions 5–7). However, when Natalie was paired with a different child (sessions 8–10) she was able to achieve fidelity of implementation of RIT without additional support. Alex and Hannah improved their use of the intervention techniques with the use of the internet-based program, although they did not initially achieve fidelity of implementation. After a 30-min coaching session, they were able reach fidelity across two additional post-training sessions.

Sample 2

During baseline, all mothers occasionally used some RIT techniques, particularly contingent imitation and linguistic mapping. All three mothers improved their use of RIT

techniques after completing the internet-based training program (see Fig. 2). Jamie and Jill achieved fidelity of implementation without additional support. Tina's use of the techniques approached fidelity after engaging in the internet-based training; however, she required an additional live coaching and demonstration session to reach fidelity of implementation.

Child Imitation

Sample 1

Across therapist-child dyads, all of the children displayed low levels of imitation during baseline sessions. After the therapists completed the internet-based training, each child's rate of imitation increased. Jake and Dean, the children paired with Alex and Hannah, both increased their

Fig. 2 Fidelity of implementation for sample 2 (parents)
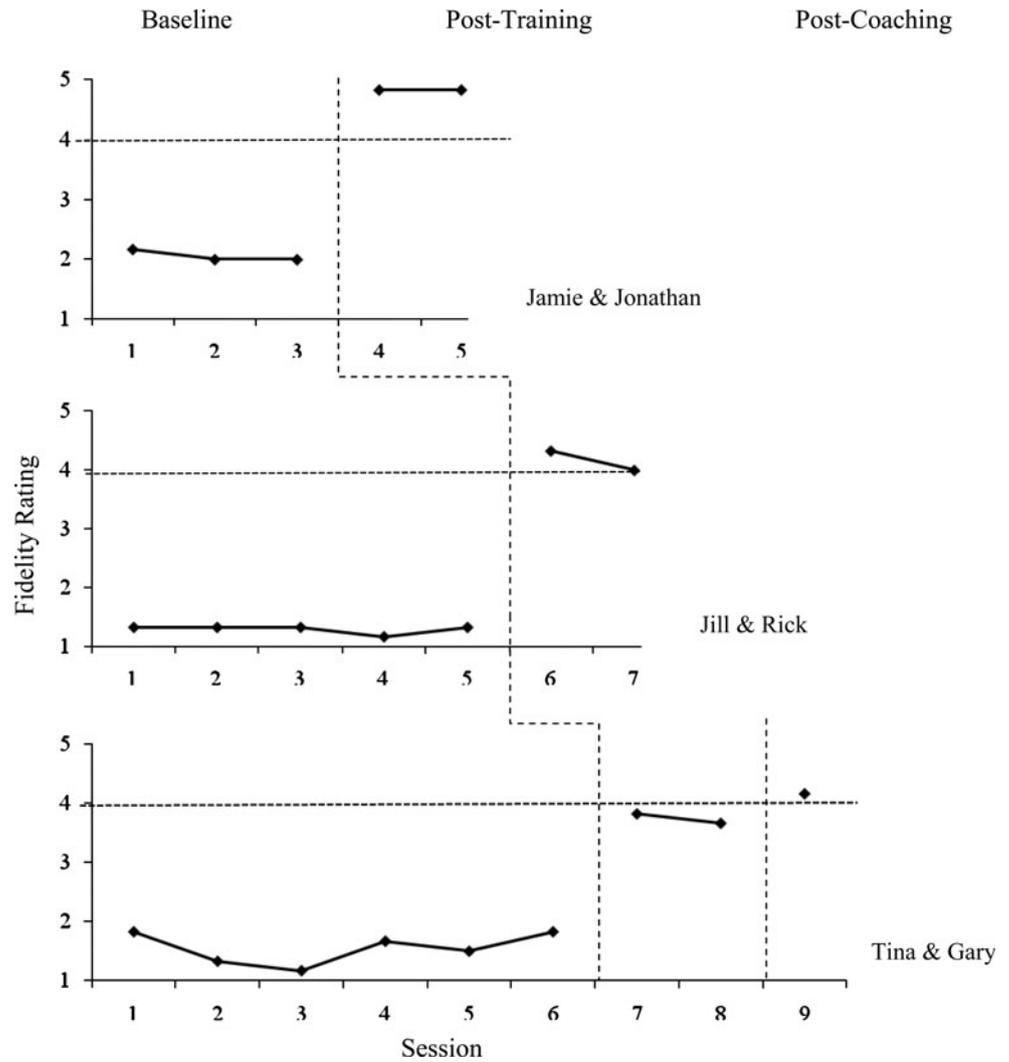
rate of imitation further after their therapist received additional coaching and achieved fidelity of implementation (see Fig. 3).

Sample 2

All children showed stable and low rates of imitation with their parents during baseline. After their parents completed the training program, Jonathan and Rick showed a substantial increase in their rate of imitation, while Gary showed a small increase in imitation (see Fig. 4). After Gary's mother, Tina, received coaching in the imitation training procedure involved with RIT and achieved fidelity of implementation, Gary's rate of imitation increased dramatically.

Treatment Acceptability

All three parents responded favorably on the modified BIRS (Table 4). In response to the open-ended question about the benefits of the program, parents indicated that the

information presented was helpful, the techniques were easy to use, and that both the parents and children had fun during RIT sessions. In response to the open-ended question about the limitations of the program, parents stated that they wished there had been more video examples to help them generate ideas for modeling appropriate play actions for imitation. Additionally, one parent stated that her internet connection was slow and thus some of the videos took longer to load. Interestingly, although Jamie and Jill were able to achieve fidelity of implementation based only on the use of the internet-based program, both indicated that they would have liked additional coaching or feedback when learning to use the intervention techniques.

Discussion

Given the growing discrepancy between the need for intervention and the availability of evidence-based treatments for individuals with ASD in the community, the

Fig. 3 Child imitation rates for sample 1. *Video from session 4 was damaged and could not be coded for imitation rates. Video from session 5 was damaged half-way through. Data until 4 min 15 s is reported for session 5
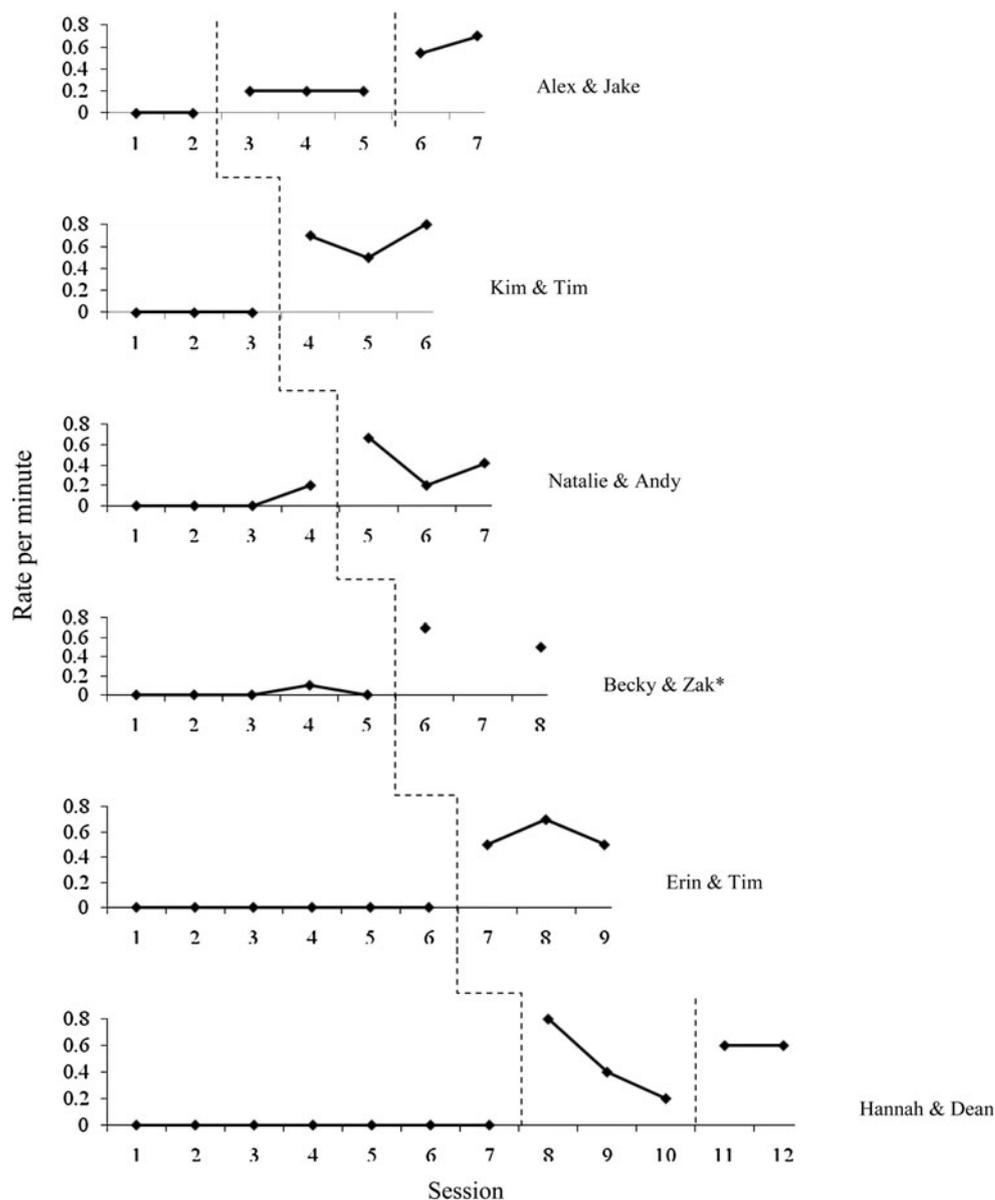
development of alternative methods of dissemination of evidence-based practice is critical. The goal of the current study was to evaluate the feasibility and preliminary efficacy of an internet-based training program for introducing evidence-based intervention techniques to individuals working with children with ASD, including parents.

Together, findings from this study support the contention that distance learning programs can be used to disseminate training to parents and providers working with children with ASD (Nefdt et al. 2010). The current study provided evidence for the efficacy and acceptability of a computerized, self-directed program for teaching evidence-based skill-building intervention techniques; all participants increased their knowledge and use of the intervention strategies. However, one-third of participants required

additional coaching in order to achieve fidelity of implementation, suggesting that self-directed training programs may not provide sufficient training for some individuals to implement evidence-based intervention techniques effectively. Moreover, parents who did not receive this coaching indicated that additional support and feedback would have been beneficial. This finding is consistent with previous literature suggesting that coaching, feedback, and "on-the-job" problem solving is critical for maximizing the effectiveness of training programs, especially those introducing evidence-based intervention techniques (e.g., Feil et al. 2008; Thomson et al. 2009).

One of the benefits of internet-based training formats is that the addition of remote coaching and feedback components can be easily integrated into the service-delivery

Fig. 4 Child imitation rates for Sample 2
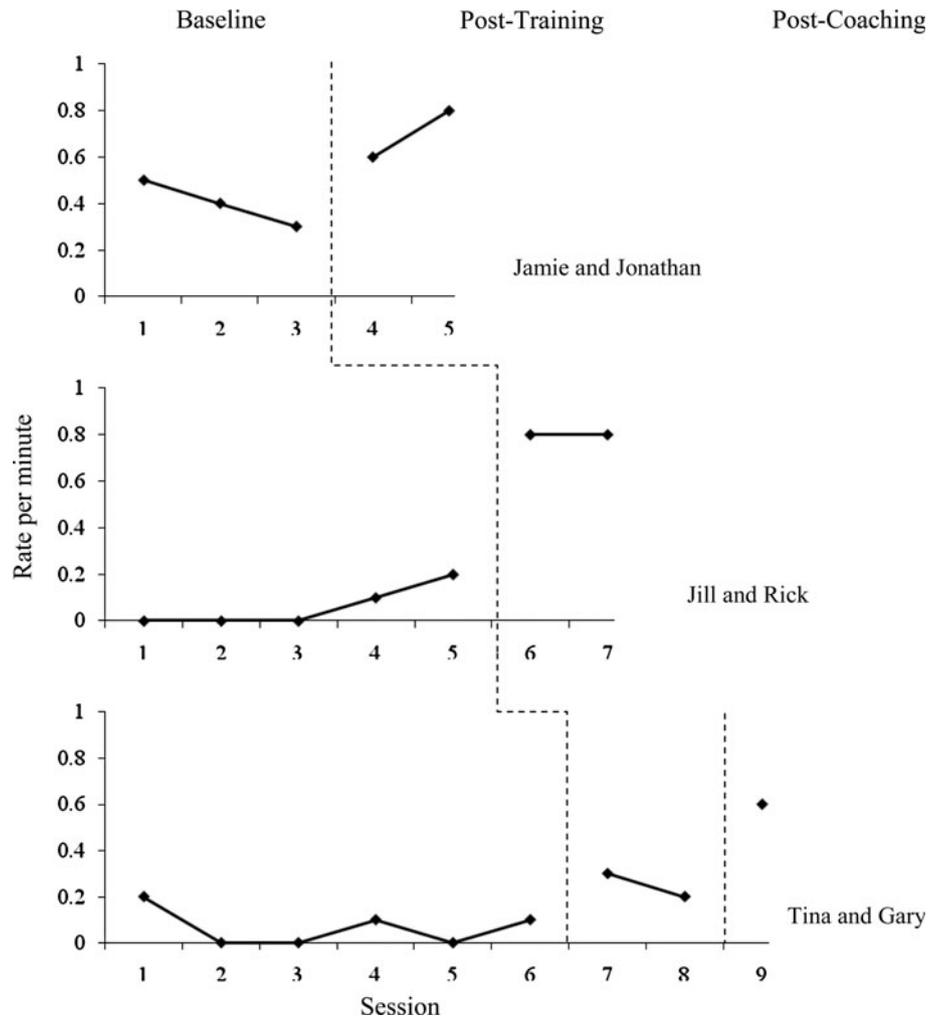
system (e.g., Feil et al. 2008). For example, Baharav and Reiser (2010) recently utilized streaming internet technology to provide live feedback and coaching to parents implementing in-home speech and language therapy. Results from their pilot study suggested that the remote coaching was both feasible and effective; they found that child gains achieved in traditional therapy settings could be maintained and improved when the parent received remote live feedback and supervision from an expert therapist. Participants in the current study were able to achieve fidelity of implementation after just one 30-min coaching session. Therefore, the use of an internet-based training program with minimal, yet sufficient, remote coaching would likely produce a significant time-savings effect relative to clinic-based training models and other more coaching-intensive distance training programs.

Across both studies, children increased their rates of imitation. This finding suggests that by utilizing RIT imitation training procedures, adults were able to elicit more imitative behaviors from the children. Previous research has demonstrated that parents' use of RIT over a 10-week

period of time can lead increases in children's spontaneous imitation, and that these skills generalized to different interaction settings (Ingersoll and Gergans 2007). Thus, although the current study did not examine spontaneous and prompted imitation separately, there is evidence to suggest that the use of the internet-based training program, and subsequent prolonged implementation of RIT, would lead to generalizable gains in spontaneous imitation skills. Future research should consider exploring these longer-term outcomes.

Importantly, parent participants indicated that this service-delivery model was both useable and acceptable. Additionally, they indicated that the RIT intervention techniques were effective for teaching their children imitation and other social-communication skills. Although parents in the current study demonstrated universally positive responses to this program, it is likely that differences in participant variables such as current life stressors, demographics, previous training, access to technology, and experience with technology would impact how an individual perceives the effectiveness and social validity of the

program. For example, previous research has demonstrated an inverse relationship between parental stress and the amount of progress made by children in a parent training program (Robbins et al. 1991). Yet in the current study all parents, including those who reported clinical levels of stress at intake, were able to complete the program, utilize the techniques correctly, and elicit changes in behavior from their children.

Jill and Jamie had previously participated in parent training programs. Although these programs introduced interventions that were quite different from RIT, both parents were able to achieve fidelity in the current study without any coaching. It is possible that Tina's lack of previous knowledge of ASD intervention may have made it more challenging for her to learn the intervention via a self-directed program alone. It should also be noted that Tina completed the entire internet-based training in just one day, whereas the other parents completed the program over several weeks. Such rapid progression through the course materials may have made it more difficult for Tina to learn the intervention techniques with fidelity. It will be essential for future research to examine the ways in which participant variables, including prior knowledge and individual use of the program, influence the acceptability and effectiveness of such a service-delivery model.

Limitations and Future Research

There are several limitations to the current study. First, the sample size of the current study is quite small. Although the use of single-subject methodology allows for a detailed examination of program feasibility and efficacy, it is unknown how well the results from the current study would generalize to other parents and service providers. Also, the duration of the study was relatively brief. It is unclear whether parents would maintain such high fidelity when utilizing RIT in the home, particularly without any opportunities for feedback and problem-solving. Thus, research evaluating the maintenance of use and fidelity of intervention techniques in the home is a critical next-step to developing an evidence-base for this service delivery model. Additionally, in order for individuals to participate in the current study, continual access to a computer and the internet was necessary. It is possible that the use of such a program may not be as feasible or acceptable for individuals with limited access to these resources. Future research should explore the effectiveness of this training program when utilized in the public domain in locations such as libraries, community agencies, schools, and hospitals. Further, the procedures involved in RIT are relatively simple and teach about prompting for only one type of skill. It is unknown whether a more complex intervention

program, targeting the development of multiple skill domains, would be able to be effectively taught via a self-directed, distance learning program. Finally, the purpose of the current study was to evaluate the initial efficacy and feasibility of this training model. However, future research must compare internet-based models to more traditional training formats such as individual in-person training or group workshops in order to understand the relative utility and effectiveness of various training models.

Summary

This study provides initial evidence for the efficacy of a self-directed, internet-based distance learning program to disseminate training in evidence-based skill building intervention techniques for young children with ASD. Such an approach has the potential to significantly increase access to evidence-based intervention services for many individuals with ASD at minimal cost. Nonetheless, a more supportive and interactive training program, providing additional feedback and coaching, may be particularly beneficial for some consumers.

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