

Award Number: W81XWH-11-1-0444

TITLE: "Using Technology to Expand and Enhance Applied Behavioral Analysis Programs for Children with Autism in Military Families"

PRINCIPAL INVESTIGATOR: Dr. Wayne Fisher

CONTRACTING ORGANIZATION: University of Nebraska
Omaha, NE 68198-6810

REPORT DATE: July 2015

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE July 2015		2. REPORT TYPE Annual		3. DATES COVERED 1 Jul 2014 - 30 Jun 2015	
4. TITLE AND SUBTITLE "Using Technology to Expand and Enhance Applied Behavioral Analysis Programs for Children with Autism in Military Families"				5a. CONTRACT NUMBER W81XWH-11-1-0444	
				5b. GRANT NUMBER AR100184	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Wayne W. Fisher, Cathleen C. Piazza, Henry S. Roane, and Kevin C. Luczynski E-Mail: wfisher@unmc.edu, cpiazza@unmc.edu, roaneh@upstate.edu, and kevin.luczynski@unmc.edu				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Nebraska Center for Autism Spectrum Disorders 985450 Nebraska Medical Center Omaha, NE 68198-5450				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Autism spectrum disorders (ASDs) are disorders that affect as many 1 in 88 children. Without intensive treatment, the long-term outcomes for children with an ASD remain bleak and are associated with a high divorce rate among parents. Interventions based on applied behavior analysis are well documented, but unfortunately these services are often not available to military-dependent children because of the lack of appropriately training individuals. This project will demonstrate how web-based technologies can increase the availability of this effective treatment. The fourth year of the award involved the continued recruitment of families with a child with an ASD to evaluate the technology-enhanced parent-training (Experiment 1) and technology-enhanced tutor-training (Experiment 2) curricula as well as the technology-enhanced early-intervention services in family's homes (Experiment 3). In addition to the preliminary results being published for the technology-enhanced tutor-training that we reported last year (Fisher, Luczynski, Hood, Lesser, Machado, & Piazza, 2014), we have conducted preliminary results for the technology-enhanced parent-training curriculum, which also showed robust and statistically significant improvements in performance. We plan to submit these data for publication in the next several months. As detailed in the current report, preliminary analyses of the technology-enhanced early-intervention services were completed					
15. SUBJECT TERMS Applied Behavior Analysis, Autism, Parent Training, Telemedicine, Tutor Training					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			USAMRMC
			UU	31	19b. TELEPHONE NUMBER (include area code)

Table of Contents

	<u>Page</u>
Introduction.....	4
Body.....	5
Key Research Accomplishments.....	25
Reportable Outcomes.....	27
Conclusion.....	28
References.....	29
Appendix.....	30

Introduction

Autism spectrum disorders (ASDs) are disorders of the brain that affect as many as 1 in 68 children. Without intensive and appropriate treatment, the long-term outcomes for children with ASDs remain bleak and are associated with a high divorce rate among parents and increased risk for mental health disorders among family members. The efficacy of and empirical support for interventions for ASDs based on applied behavior analysis (ABA) is well documented. Unfortunately, these services are often not available to military-dependent children because there are not enough appropriately trained individuals to design and provide ABA services. This project will demonstrate how web-based technologies can increase the availability of effective treatment for children with ASDs. By evaluating a technology-enhanced treatment delivery model, families will be able to receive empirically supported treatment services in a timely manner anywhere in the world. Also, training therapists to implement ABA programs using a web-based model will greatly increase the number of well-trained therapists in areas around many military bases.

Body

Task 2. Complete parent and tutor training and EIBI aims for 5 cohorts, which includes 50 participant families and their ABA tutors (timeframe, Months 12-44).

From Statement of Work: Tasks include three distinct sub-tasks for each cohort. Our training protocol based on E-Learning using the latest web-based and televideo-based instruction will provide an efficient and effective mechanism for training military parents of children with autism anywhere in the world by experts in one location (University of Nebraska Medical Center in Omaha). These trained parents will then be able to implement effective behavior management and teaching strategies with high procedural integrity (90% accuracy). Second, we will use the protocol we developed to train adults to become ABA tutors and to implement early intervention procedures with high integrity (90% accuracy) in areas of the world where such services are unavailable. The training protocol (using web-based E-Learning instructional methods) will be the same for the parents and the ABA tutors, but they will have more extensive curricula (with the curriculum for the ABA tutors being more comprehensive). Third, we will evaluate changes in cognitive, language, social, play, and adaptive skills and decreases in problem behaviors among children with autism in military families who receive technology-enhanced early intervention services that are supervised by our experts. The children in the technology-enhanced early intervention treatment group will show significantly greater improvements than children randomly assigned to a waitlist-control group.

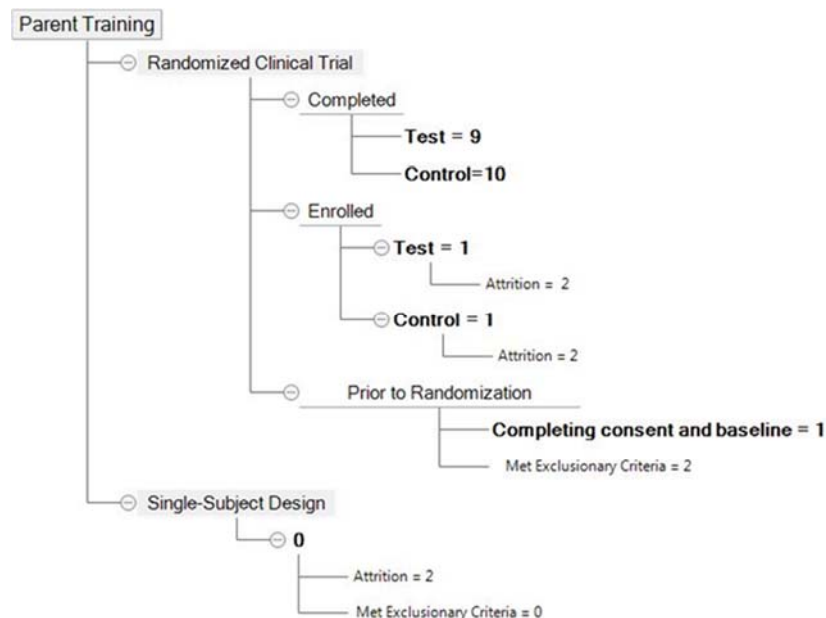
In each cohort, there will be 10 children with autism recruited with at least one parent (cohort $n \Rightarrow 10$) and one ABA tutor (cohort $n \Rightarrow 10$) per child. In the first cohort, 5 of the children and their corresponding parents ($n \Rightarrow 5$) and ABA tutors ($n \Rightarrow 5$) will be randomly assigned to the technology-enhanced early intervention treatment group and the other 5 children and their corresponding parents ($n \Rightarrow 5$) and ABA tutors ($n \Rightarrow 5$) will be assigned to the waitlist-control group.

We have reported progress for Experiments 1, 2, & 3 in this order.

Parent-training Evaluation (Experiment 1)

1. *Randomized Clinical Trial: Recruit, pretest, and train parents in the technology-enhanced test group and parents in the waitlist-control group.* Schematic 1 details the progress for the technology-enhanced parent-training evaluation (Experiment 1).

Schematic 1.



- a. We have outcome data for the between-subjects comparison with 9 parents that were randomized to the technology-enhanced group and 10 parents that were randomized to the waitlist-control group. The difference in the numbers across the groups is due to attrition, as denoted in the schematic. In addition, an additional parent is progressing through the technology-enhanced training while two other parents have been assigned to the waitlist-control group. We will continue to enroll parents as we enroll families for the early-intervention services in Experiment 3. In Figures 1 and 2, we present the initial outcome data for the parents who have completed Experiment 1.

In Figure 1, the type of assessment is depicted on the x-axis. The top panel shows the participants' performance for the Behavioral Implementation Skills for Work Activities (BISWA) assessment and the bottom panel shows the participants' performance for the Behavioral Implementation Skills for Play Activities (BISPA). The gray and white bars denote the average performance across all participants for the test and waitlist-control groups, respectively; the open circles denote the individual performance for each participant in each group. The percentage of trials implemented correctly is depicted on the y-axis, and this measure was calculated by dividing the total number of trials implemented correctly plus the total number of errors, including both errors of commission (implementing a skill incorrectly; e.g., delivering reinforcement following an incorrect response) and errors of omission (failing to implement a skill when required; e.g., omitting descriptive praise following a correct response). This method of scoring provided an overall measure of how accurately the tutors carried out the procedures, regardless of the unequal number of programmed opportunities across the types of confederate responses.

Prior to experiencing the technology-enhanced training, all of the parents' performance was unsatisfactory across both primary dependent measures and comparable across groups, with relatively worse performance for the BISPA. Following the technology-enhanced training, parents showed robust improvements in performance. All parents implemented the skills correctly on more than 80% of the trials on the BISWA and BISPA assessments (gray bar on posttest column); by contrast, the performance of the parents in the control group showed no improvement (white bar on posttest column).

In Figure 2, instead of reporting the percentage of trials implemented correctly on the y-axis, the percentage of skills implemented correctly for each *component skill* (e.g., delivers behavior-specific instructions) is depicted. This method of scoring provided information on which specific skills the parents were implementing with high fidelity and which ones should be targeted for additional training, and this method controlled for differences in the number of programmed opportunities across the types of confederate responses.

As observed in Figure 1, notable and robust differences were observed for the parents who received the technology-enhanced training for the BISWA (top panel) and BISPA (bottom panel), and no improvement was observed for the parents assigned to the waitlist-control group.

Figure 1.

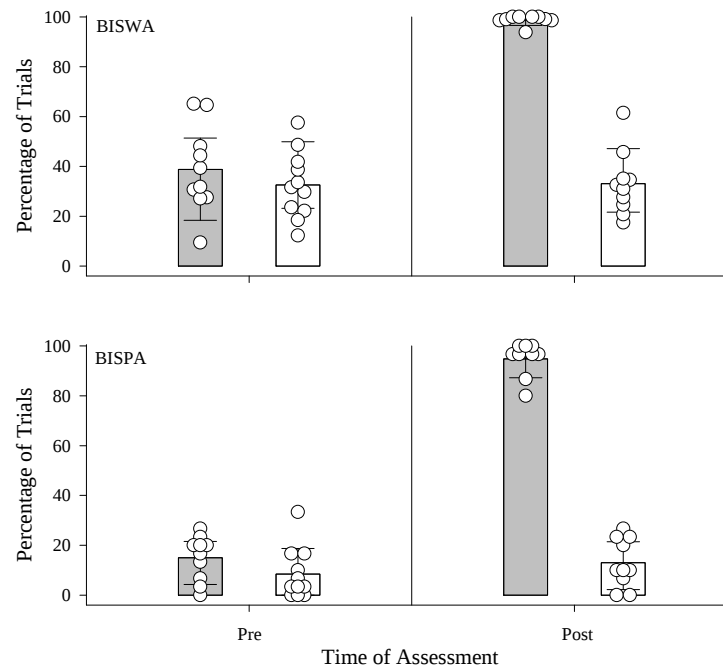
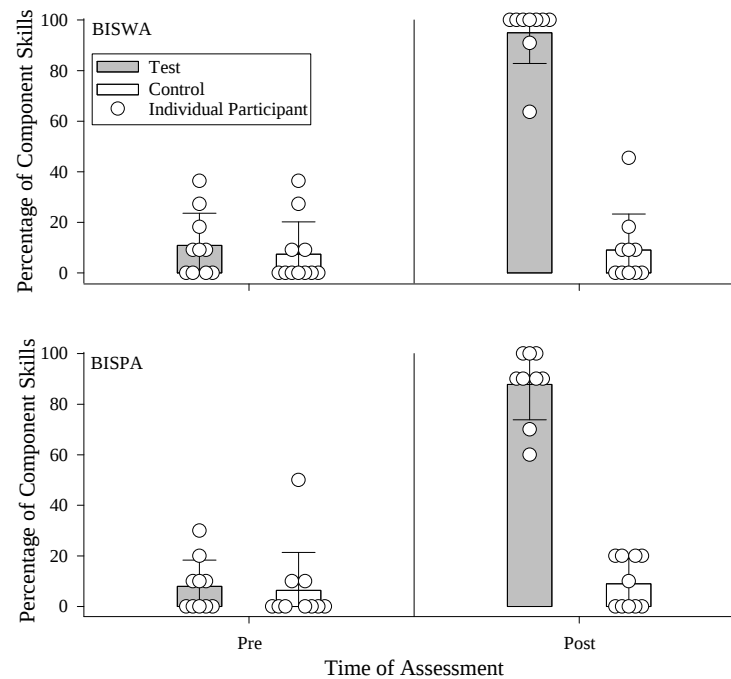


Figure 2.



- b. In addition to visual inspection of the outcomes in Figures 1 and 2, we report the aggregated results for a subset of the participants in Figure 3 below. The analysis included 4 parents assigned to the technology-enhanced test group and 6 parents to the waitlist control group. In addition, the results from the preliminary statistical tests are summarized in text and in Table 1.

The type of assessment is depicted on the x-axis. The right panel shows the participants' performance for the BISWA and the left panel shows the participants' performance for BISPA. The black and white symbols denote the mean performance across all participants for the test and waitlist-control groups, respectively. In the top panel, the percentage of trials implemented correctly is depicted on the y-axis, and this measure was calculated as described above. Both groups performed poorly on the BISPA (Figure 3, upper-left panel) during the pretest ($M_s = 19.17\%$ and 13.89% on the pretest for the treatment and control groups, respectively). The difference between the means for the treatment and control groups on the posttest was large ($M_s = 90.83\%$ and 11.11% on the posttest for the treatment and control groups, respectively). We analyzed the data with a general linear model using performance on the pretest as a covariable, and the top panel of Table 1 below shows the results of this analysis. The difference between the treatment and control group means on the posttest was large (i.e., partial eta squared of .969, which is equivalent to a Cohen's d of 11.18) and statistically significant ($F = 216.15$; $p < .001$).

Similar results were obtained for the percentage of trials implemented correctly on the BISWA, which are depicted in the upper-right panel of Figure 3. The groups performed similarly on the BISWA pretest ($M_s = 44.63\%$ and 43.21% for the treatment and control groups, respectively), but the difference was notably larger on the posttest ($M_s = 99.44\%$ and 41.59% for the treatment and control groups, respectively). The difference between the treatment and control group means on the posttest was large (i.e., a partial eta squared of .823; which is equivalent to a Cohen's d of 4.31) and statistically significant ($F = 32.56$; $p < .001$).

The bottom-left panel of Figure 3 shows the mean percentage of component skills mastered for the BISPA across the treatment and control groups. Both groups displayed mastery performance on a small percentage of the skills ($M_s = 7.5\%$ and 11.67% on the pretest for the treatment and control groups, respectively). By contrast, the treatment group had mastered the majority of the component skills by the posttest, whereas the control showed little improvement ($M_s = 87.5\%$ and 1.67% on the posttest for the treatment and control groups, respectively). In the bottom panel of Table 1, when statistically controlling for the effects of the pretest, the difference between the treatment and control group means on the posttest was large (i.e., partial eta squared of .927; which is equivalent to a Cohen's d of 7.13) and statistically significant ($F = 76.25$; $p < .001$).

The bottom-right panel of Figure 3 depicts the results for the mean percentage of component skills mastered on the BISWA. Both groups displayed mastery performance on a small percentage of the skills ($M_s = 22.73\%$ and 16.67% on the pretest for the treatment and control groups, respectively). By contrast, all parents in the treatment group mastered all of the component skills by the posttest, whereas the control showed only slight improvement ($M_s = 100.00\%$ and 21.21% on the posttest for the treatment and control groups, respectively). The difference between the treatment and control group on the posttest was large (i.e., partial eta squared of .606; which is equivalent to a Cohen's d of 2.48) and statistically significant ($F = 9.24$; $p < .023$).

These data were presented at our field's annual convention - Association for Behavior Analysis International - this May (Fisher, Luczynski, Machado, Lesser, Hood, Blowers, Pisman, & Vosters, 2015). We plan to submit these data for publication in the next couple of months to our field's applied flagship journal named the *Journal of Applied Behavior Analysis*.

Figure 3.

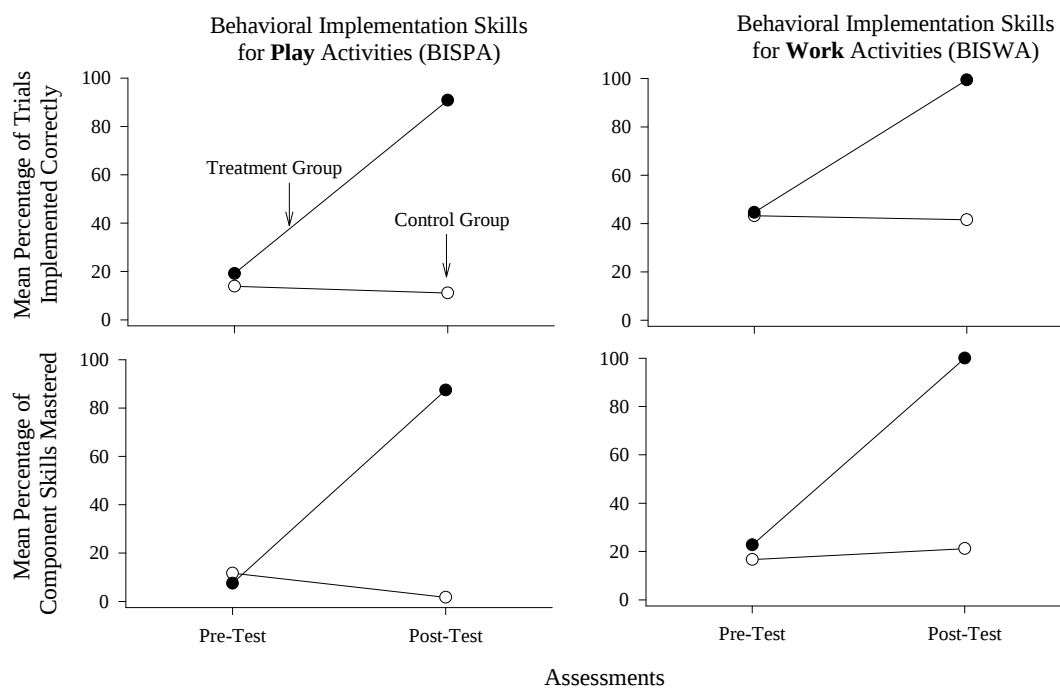


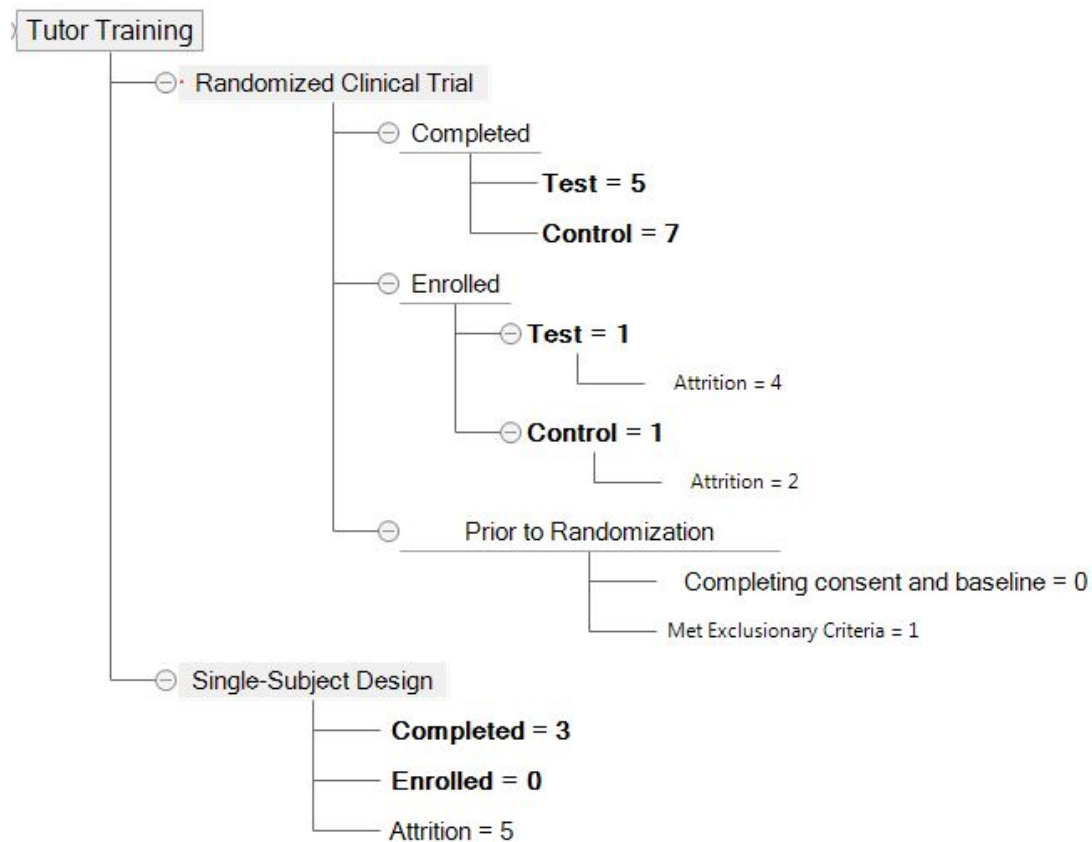
Table 1
Between-Groups Inferential Statistics

	Type III Sum of Squares	<u>df</u>	Mean Square	F	Sig.	Partial Eta Squared	<u>Noncent Parameter</u>	<u>Observed Power^B</u>
Mean Percentage of Trials Skills Mastered								
Behavioral Implementation Skills for Play Activities (BISPA)								
Corrected Model	15504.75	2	7752.38	130.33	.000	.974	260.67	1.00
Intercept	3444.28	1	3444.28	57.91	.000	.892	57.91	1.00
Group	12856.37	1	12856.37	216.15	.000	.969	216.15	1.00
PreTest	251.23	1	251.23	4.22	.079	.376	4.22	.426
Error	416.36	7	59.48					
Total	34411.11							
Corrected Total	15921.11							
Behavioral Implementation Skills for Work Activities (BISWA)								
Corrected Model	8048.16	2	4024.08	16.51	.002	.825	33.02	.986
Intercept	1790.64	1	1790.64	7.35	.030	.512	7.35	.644
Group	7937.42	1	7937.42	32.56	.001	.823	32.56	.998
PreTest	14.63	1	14.63	.06	.813	.009	.06	.055
Error	1706.23	7	243.75					
Total	51653.40							
Corrected Total	9754.40							
Mean Percentage of Components Implemented Correctly								
Behavioral Implementation Skills for Play Activities (BISPA)								
Corrected Model	18193.18	3	6064.40	56.25	.000	.966	168.76	1.000
Intercept	9009.21	1	9009.21	83.57	.000	.933	83.57	1.000
Group	8220.35	1	8220.35	76.25	.000	.927	76.25	1.000
PreTest	440.44	1	440.44	4.09	.090	.405	4.09	.398
Group x PreTest*	452.02	1	452.02	4.19	.087	.411	4.19	.406
Error	646.82	6	107.80					
Total	31800.00							
Corrected Total	18840.00							
Behavioral Implementation Skills for Work Activities (BISWA)								
Corrected Model	15127.96	3	5042.65	25.16	.001	.926	75.48	1.000
Intercept	7585.46	1	7585.46	37.85	.001	.863	37.85	.999
Group	1852.21	1	1852.21	9.24	.023	.606	9.24	.718
PreTest	229.89	2	114.94	.57	.592	.160	1.15	.108
Error	1202.62	6	200.44					
Total	44132.23							
Corrected Total	16330.58							

Tutor-training Evaluation (Experiment 2)

2. *Randomized Clinical Trial: Recruit, pretest, and train tutors in the technology-enhanced test group and tutors in the waitlist-control group.* Schematic 2 details the progress for the technology-enhanced tutor-training evaluation.

Schematic 2.



- a. *Efficacy Outcomes:* In last year's annual report, we reported that we published preliminary outcome data for the between-subjects comparison given the significant outcomes with four completed participants in both the technology-enhanced training and waitlist control groups (5-year Impact Factor, 2.665; Fisher, Luczynski, Hood, Lesser, Machado, & Pizza, 2014). Four additional participants have completed the evaluation, one test and three control participants, and two additional participants are currently enrolled. Given that our primary focus at this point is producing outcome data on the effectiveness of our technology-enhanced in-home services for children with autism spectrum disorders (Experiment 3), we are not enrolling additional tutors for this aim unless a tutor is needed to provide in-home services for a child in Experiment 3. The performance for all participants who have completed the randomized clinical-trial evaluation are depicted in Figures 4 and 5 in same manner as described for Figures 1 and 2 above for the parent-training evaluation.

- b. In Figure 4, prior to experiencing the technology-enhanced training, all of the tutors' performance was unsatisfactory across both primary dependent measures and comparable across groups, with relatively worse performance for the BISPA. Following the technology-enhanced training, the preliminary results with the tutors show robust improvements in performance. All tutors implemented the skills correctly on more than 80% of the trials on the BISWA and BISPA assessments (gray bar on posttest column); by contrast, the performance of the tutors in the control group showed no improvement (white bar on posttest column).

In Figure 5, instead of reporting the percentage of trials implemented correctly on the y-axis, the percentage of skills implemented correctly for each component skill is depicted. As observed in Figure 4, notable, robust differences were observed for the tutors who received the technology-enhanced training for the BISWA (top panel) and BISPA (bottom panel), and no improvement was observed for the tutors assigned to the waitlist-control group.

Figure 4.

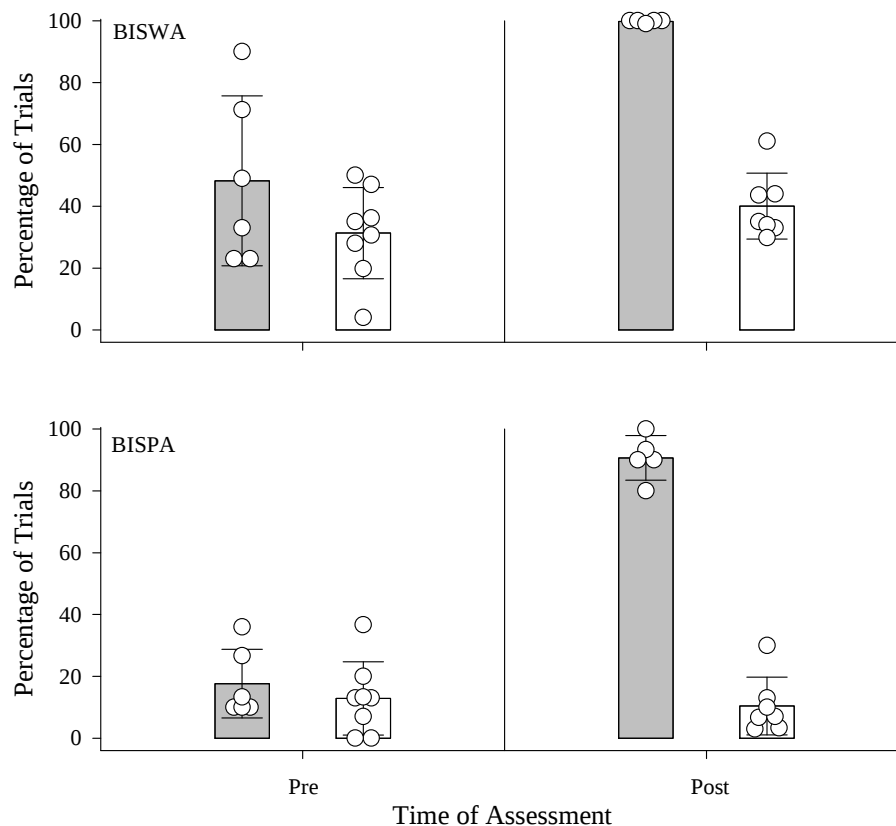
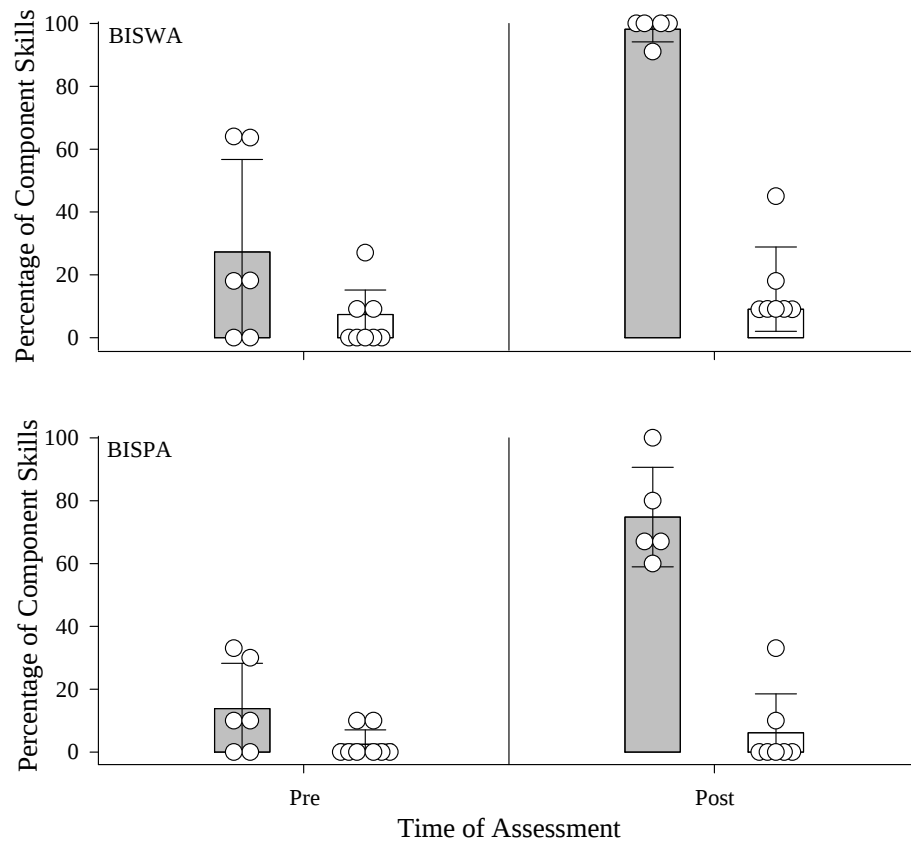


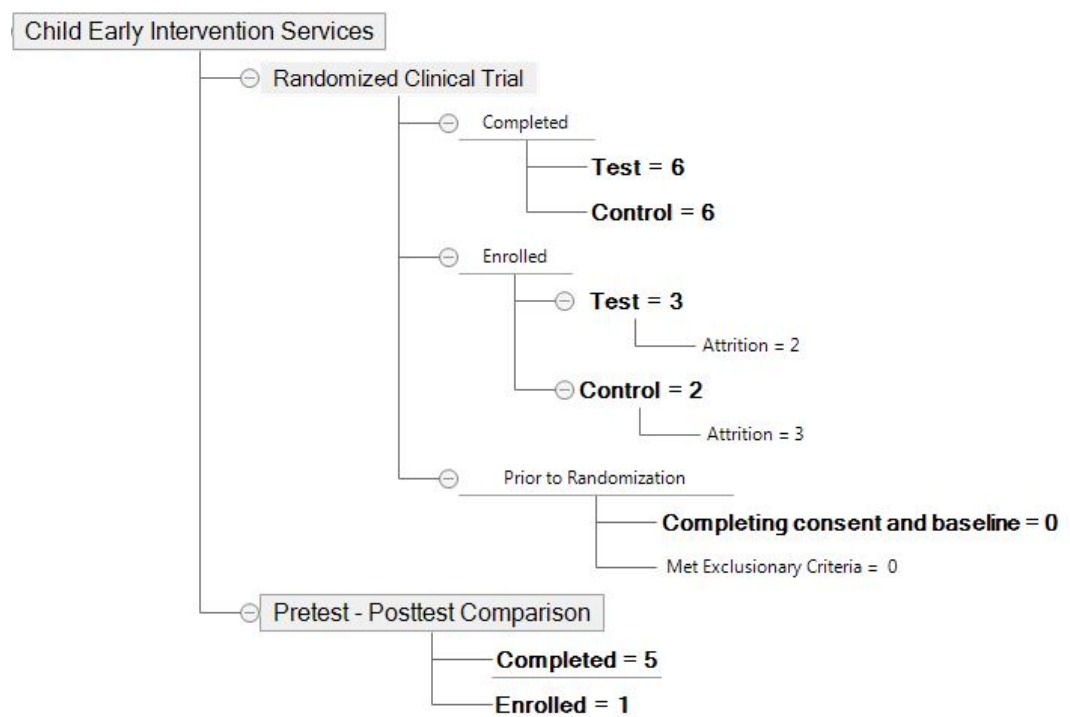
Figure 5.



Child-Training Evaluation (Experiment 3)

3. *Recruit, pretest, and train and treat 10 children in the technology-enhanced test group and 10 children in the waitlist-control group.* Schematic 3 details the progress for the technology-enhanced early-intervention services for children with autism (Experiments 3).

Schematic 3.



- a. Randomized Clinical Trial. We have randomly assigned 17 children to the technology-enhanced training group and waitlist-control groups, resulting in 9 test-control dyads. The duration of in-home services (i.e., dose of ABA therapy) for the six children in the technology-enhanced training group are depicted below in Figure 4 below. The six children are depicted on the y-axis and the dose of in-home services (in months) is depicted on the x-axis. To date, six test-control dyads (i.e., 12 participants) have matriculated through the randomized clinical trial. As a result, we have completed the posttest assessments for five children in the test group as well as the posttests for their peers in the waitlist-control group.
- i. *Skills-based Dependent Measure*: The dependent measures for Experiment 3 include a battery of standardized assessments, including the Peabody Picture Vocabulary Test, Expressive Vocabulary Test, and Mullen Scale of Early Learning. In addition to these standardized assessments, we designed an assessment that sampled skill domains for early learners. The skills we assessed was informed by the domains tested in the Assessment of Basic Language and Learning Abilities, a common assessment in the early-intervention literature that qualitatively and quantitatively defines a child's current skill level that guides intervention development.

In Figures 6 and 7 below, the results for each matched test-control dyad on the skills-based dependent measures that were determined as a percentage of trials (i.e., trial-based) are depicted. The trial-based skills are depicted on the x-axis, and the difference score in the percentage of trials between the pretest and posttest is depicted on the y-axis. The difference scores were calculated by subtracting the percentage of trials with correct responding on the posttest from the percentage of trials with correct responding on pretest for each domain. At the far right of each figure, the mean of the differences from pretest to posttest across all skill domains is reported. Positive scores represent an improvement, and negative scores represent a worsening. Black and white bars denote the child assigned to the test and control groups, respectively.

Figure 6.

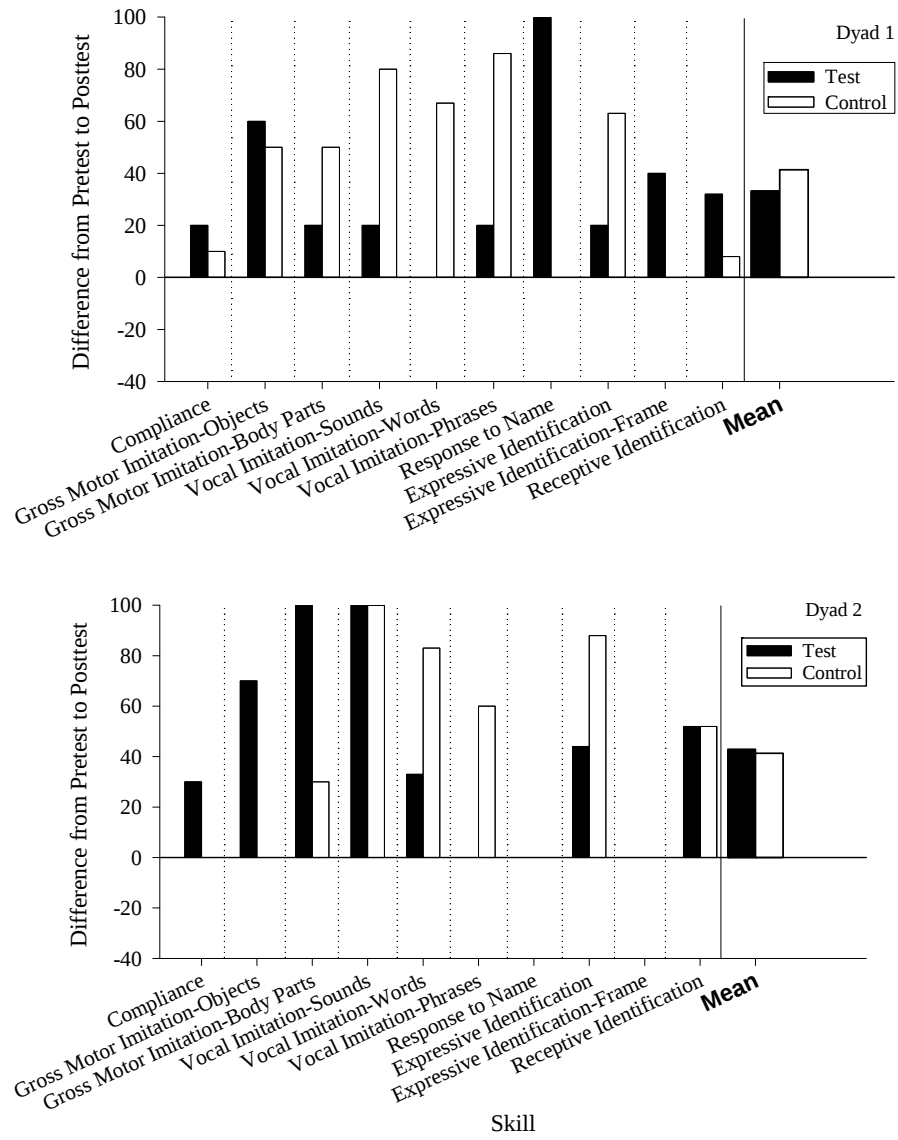
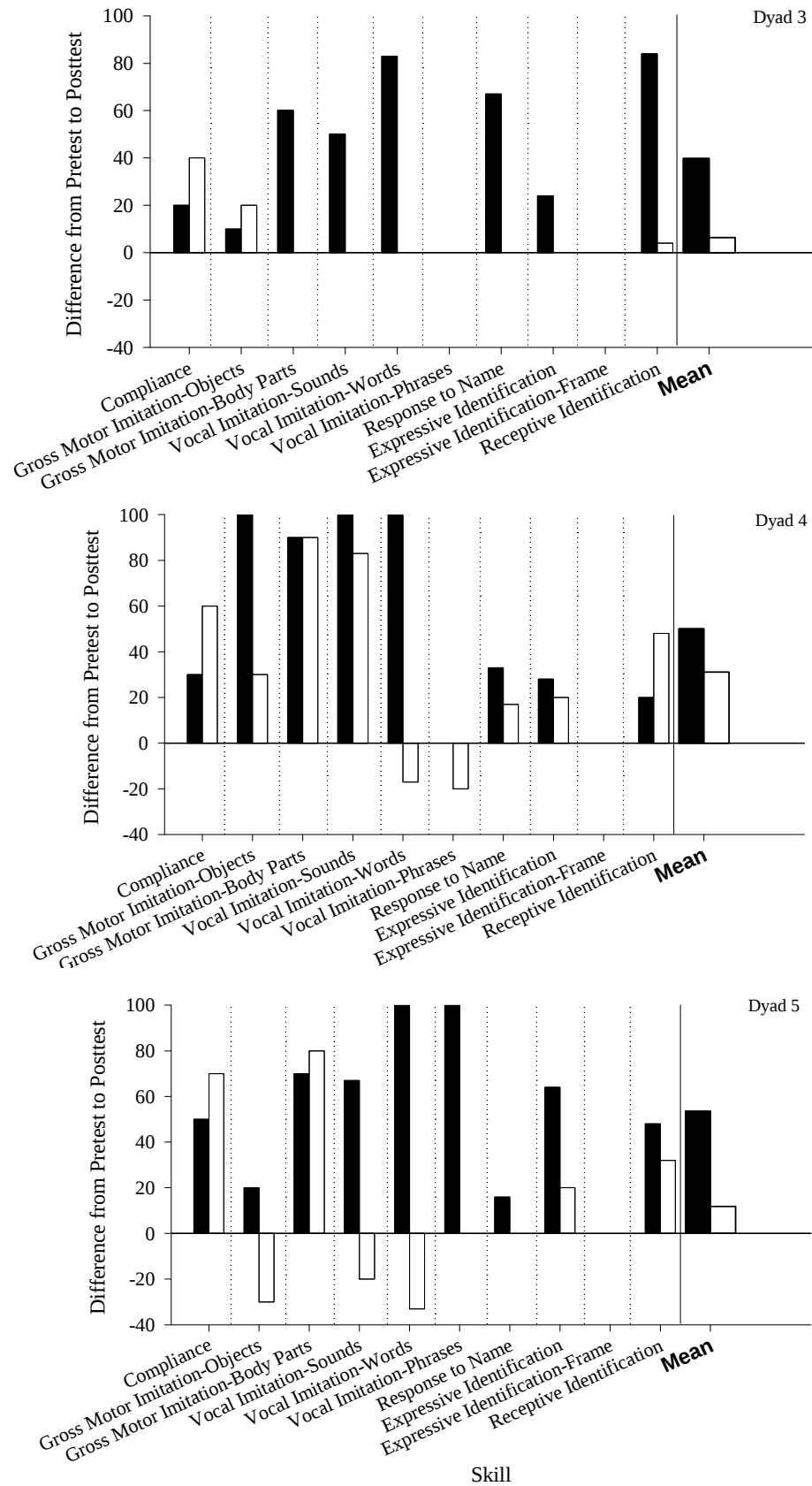


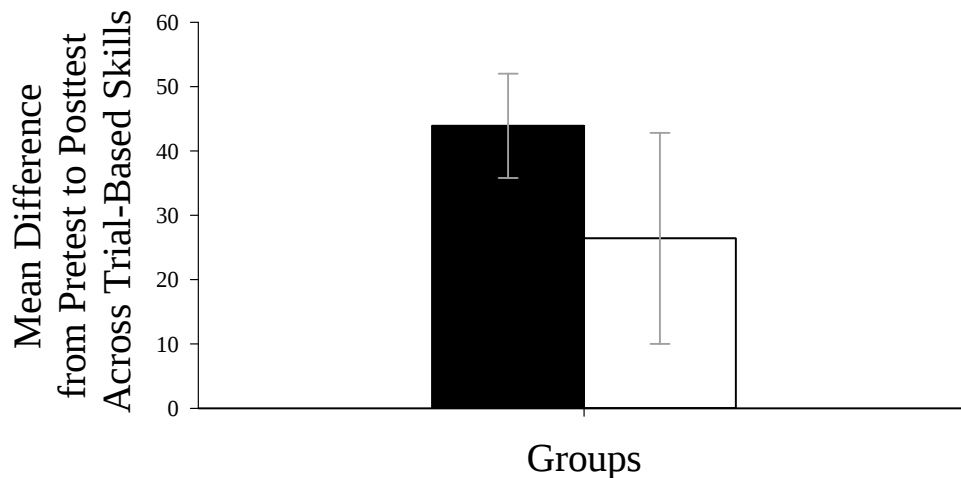
Figure 7.



For the Dyads 1 (top panel) and 2 (bottom panel) in Figure 6, the children assigned to the technology-enhanced group showed improvement across the majority of skill domains, although the increase in performance was minimal (20% to 30%) for several domains. Unexpectedly, improvement across the skill domains was also observed for children assigned to the waitlist-control group. As a result, increases in performance were similar across children as shown by the mean at the far right of each panel, regardless of group assignment. By contrast, for the three dyads in Figure 7, there were notable skill improvements for the children assigned to the technology-enhanced group compared to their peer in the control group, which is highlighted by the means in the far-right bars.

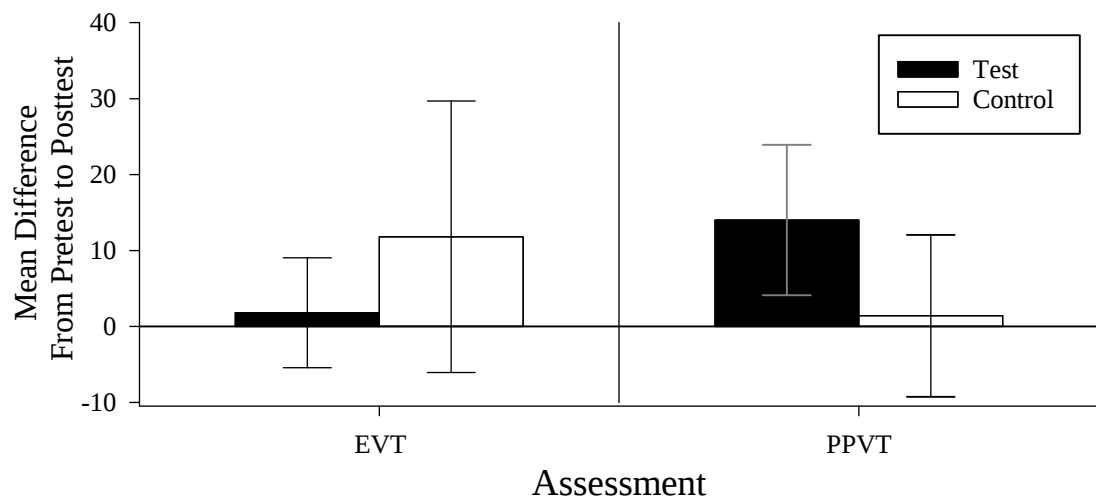
Figure 8 below reports the mean across all children assigned to each group for the trial-based skills (top panel). The mean across groups for the trial-based skills for the children who were assigned to the technology-enhanced test group ($M = 43\%$) represented a larger improvement compared to the children assigned to the waitlist control group ($M = 27\%$).

Figure 8.



- ii. *Standardized Dependent Measures*: The results for the Expressive Vocabulary Test (EVT; left panel) and Peabody Picture Vocabulary Test (PPVT; right panel) are reported in Figure 9. The type of assessment (pre vs. post) is depicted on the x-axis; the mean difference from pretest to posttest is reported on the y-axis. The black and white bars denote the mean performance across the five participants for the test and waitlist-control groups, respectively; the line for each bar denotes the standard deviation. We have not observed consistent differences between the children assigned to the test and control groups for the EVT; there was a larger increase from pretest to posttest for the PPVT. It should be noted that the sample size for the children that have completed the posttest is small at this point.

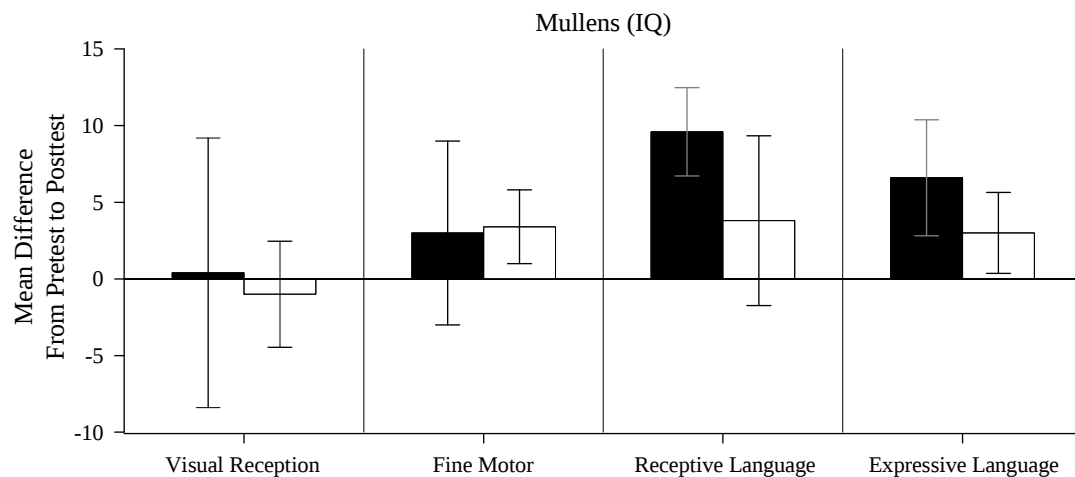
Figure 9.



The results for the Mullens Scale of Early Learning are reported in Figure 10. The domains in the assessment are denoted across the four phases, and pretest and posttest measures are reported in each phase. As in Figure 9, the black and white bars denote the mean of participants' performance in the test and control groups, respectively. Visual inspection of the figure involves looking for relative increases in the height of the mean from pretest to posttest.

An improvement from pretest to posttest for children assigned to the test group was observed for the fine motor, receptive language, and expressive language. However, the degree of improvement does not notably exceed that observed for the children assigned to the waitlist control group.

Figure 10.



- b. Pretest-Posttest Evaluation. As detailed in last year's annual report, we modified the research methodology to help to address our recruitment shortfall. The research modification is described below. When the children assigned to the technology-enhanced test group matriculated, the 6 months of early intervention services for their peer in the waitlist-control group started. For a subset of children, we provided the same 6-month dose of early-intervention services to the children who were in the waitlist-control group and including their data in the statistical analyses of the effects of our technology-enhanced services. This modification will contribute to the experimental design in that it will allow for both an across-group comparison between the test and control groups as well as a within-subject comparison prior to and after the provision of our technology-enhanced early intervention services.
- i. *Skills-based Dependent Measure*: Four children have participated in this evaluation in which there were a pretest was conducted, then a posttest was conducted after not receiving our technology-enhanced training, and then a second posttest was conducted after receiving approximately 6-months of technology-enhanced training. Below in Figures 11 and 12 are difference scores between the participants' performance in the first *posttest* (posttest one) and the second *posttest* (posttest 2) across the skill domains; the mean difference across all domains is depicted in the far-right white and black bar on the panel. In this graphical depiction, we are looking for larger within-subject differences in the white bar (posttest 2) relative to the black bar (posttest 1).

We observed notable differences for participants 2 and 4 children in posttest 2 relative to posttest 1. A larger difference was observed in the posttest 1 for participant 1 and similar differences were observed for participant 3. It should be noted that lack of

improvement in posttest 2 for the latter two participants is likely affected, in part, by ceiling effects for some of the skills. That is, if the participant performed near mastery in posttest 1 for a skill domain, there is not an opportunity for further improvement in posttest 2.

Figure 11.

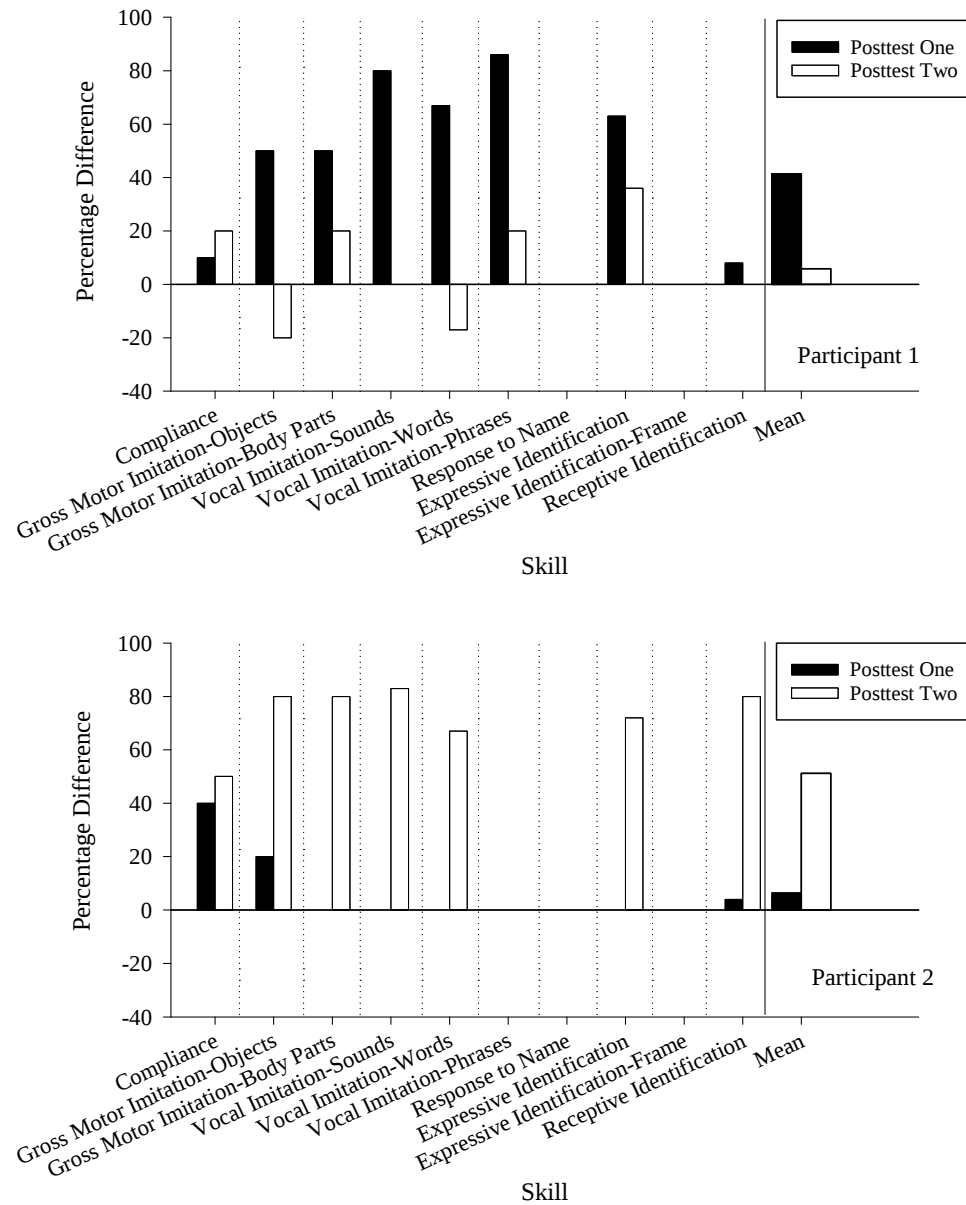


Figure 12.

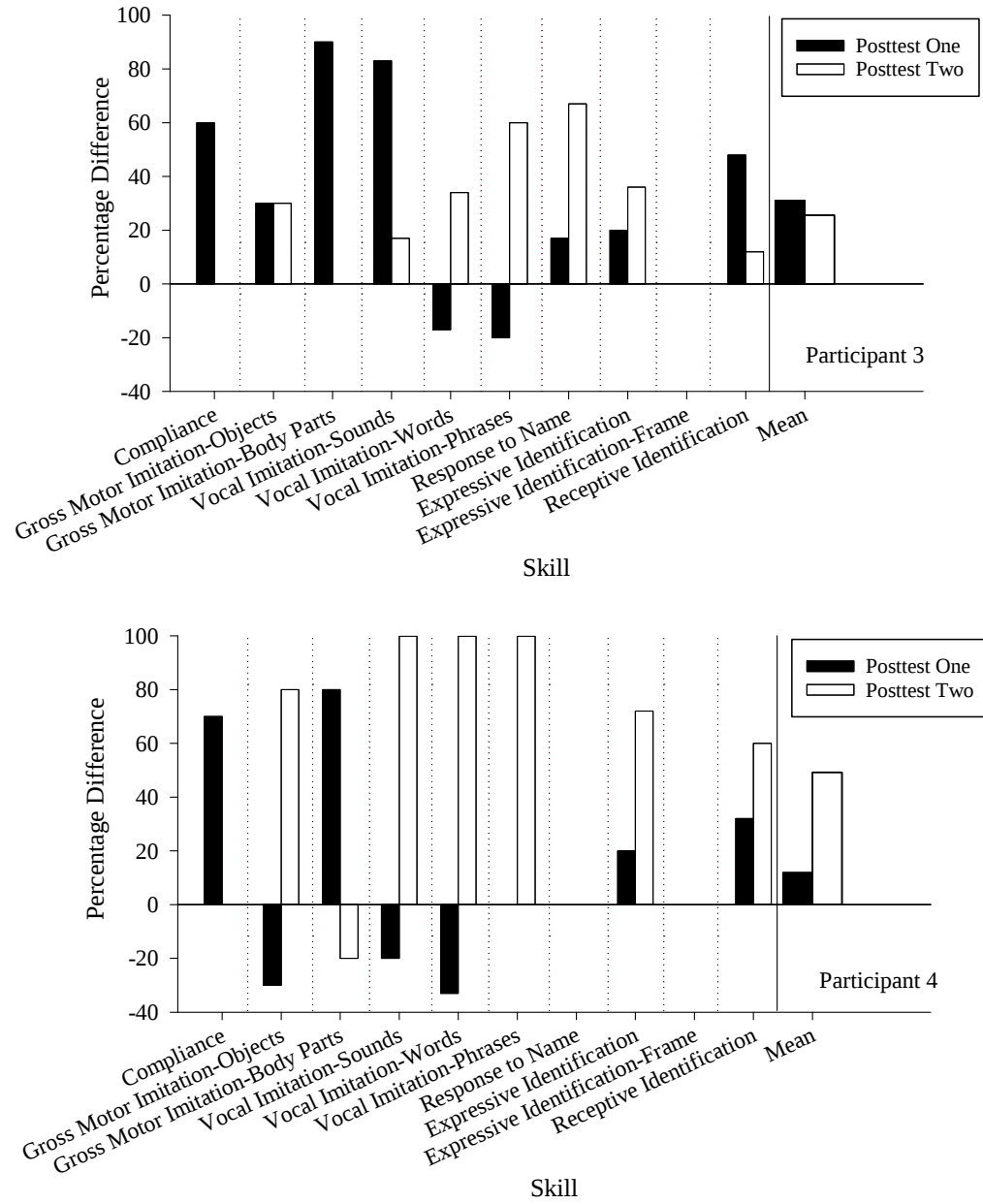
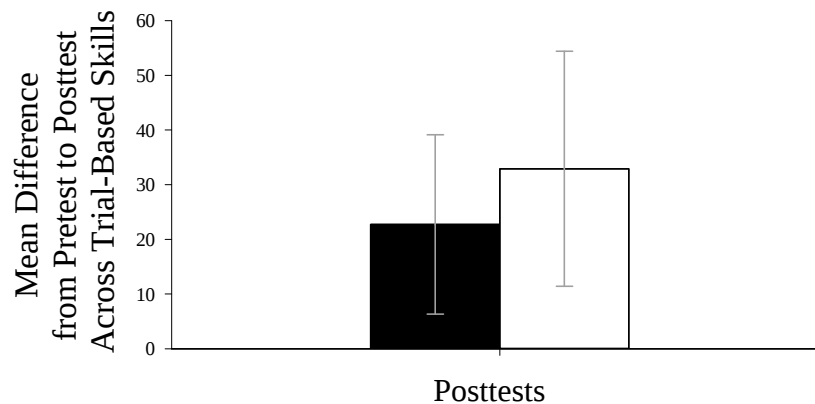


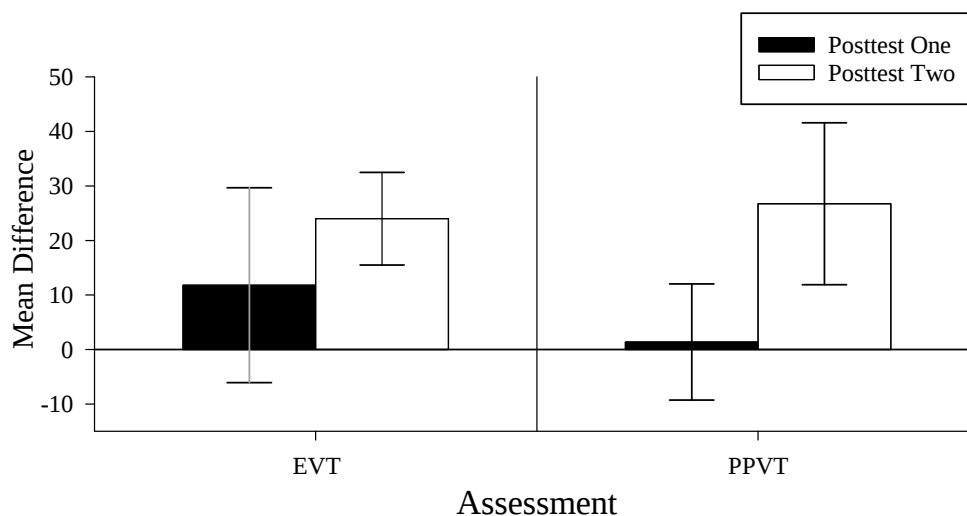
Figure 13 below reports the mean difference across all children in posttest 1 and posttest 2 for the skill domains. The mean difference in posttest 2 ($M = 32.9\%$) represented an improvement compared to posttest 1 ($M = 27\%$), but there is notable variability across children in both posttests.

Figure 13.



- ii. *Standardized Dependent Measures:* The results for the Expressive Vocabulary Test (EVT; left panel) and Peabody Picture Vocabulary Test (PPVT; right panel) for the same four children are reported in Figure 14. The type of assessment (pre vs. post) is depicted on the x-axis; the mean difference from pretest to posttest 1 and posttest 1 to posttest 2, as described for figures 11 to 13, is reported on the y-axis. The black and white bars denote the mean performance across the five participants for the test and waitlist-control groups, respectively; the line for each bar denotes the standard deviation. For both the EVT and PPVT, participants, on average, performed better on posttest 2, which followed approximately 6 months of technology-enhanced early-intervention services. The most notable difference was observed with the PPVT.

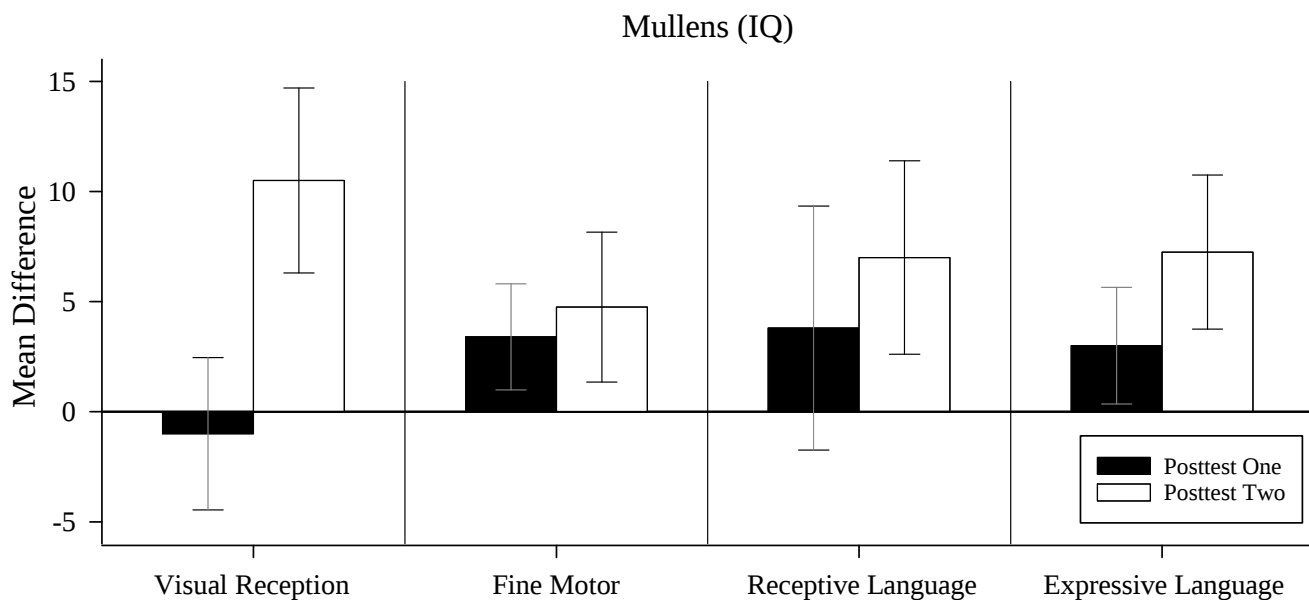
Figure 14.



The results for the Mullens Scale of Early Learning are reported in Figure 14. The domains in the assessment are denoted across the four phases, and the mean posttest 1 and posttest 2 measures are reported in each phase. Visual inspection of the figure involves looking for relative increases in the height of the mean between the posttests.

An improvement in posttest 2 was observed for all skill areas, and this improvement was better than that observed in posttest 1. However, there is notable overlap in the standard deviations for fine motor and receptive language.

Figure 14.



- c. Continued Recruitment Efforts. Over the last year, we made notable progress in obtaining outcomes for the technology-enhanced parent-training (Experiment 1), which produced robust, convincing findings that will soon be submitted for publication in a peer-reviewed journal, and we made decent progress in obtaining outcomes for the technology-enhanced early-intervention training (Experiment 3). As detailed above, the outcomes to date strongly support the efficacy and social acceptability of the technology-enhanced remote training for tutors and parents. Given the historical difficulty in increasing awareness about our technology-enhanced in-home services to families, we are excited by our progress toward designing and monitoring early intervention services. We recognize that primary focus in the final year of the grant is geared toward recruiting and completing more children toward the aims in Experiment 3, and below we list some efforts toward making continued progress.
 - i. Toward efforts to increase our recruitment numbers for our technology-enhanced in-home early intervention services locally, Dr. Luczynski has presented information on the grant procedures and aims in Kearney Nebraska, which is a rural city in Nebraska. In addition, the founder of Kids & Dreams Foundation, Mr. Aaron Bly, who

lives and interacts with families in rural Nebraska has agreed to promote awareness of our grant.

- ii. Nebraska became the 36th state to enact autism insurance near the end of 2014, and now, in 2015, insurers are required to cover the diagnosis and treatment of autism spectrum disorders. In addition, due to a recent lawsuit, Nebraska Medicaid has begun approving applied-behavior-analysis services for children with autism. The effects of this mandate and the lawsuit is increasing the availability applied behavior analysis to families, which is line with our focus this year on recruiting families and children with autism for our technology-enhanced early-intervention aim (Experiment 3).

Key Research Accomplishments

Technology-enhanced Parent-training Curricula: We have outcome data for the between-subjects comparison with 9 parents that were randomized to the technology-enhanced group and 10 parents that were randomized to the waitlist-control group. As observed and reported for the technology-enhanced tutor-training evaluation in last year's report, visual inspection of the results clearly show the efficacy of the technology-enhanced (web-based) training procedures. In addition, statistically significant between-group differences were obtained using a hierarchical linear model for parents who received the technology-enhanced training for the standardized measures (BISWA and BISPA), and no improvement was observed for the parents assigned to the waitlist-control group. These results were presented at our field's annual convention - Association for Behavior Analysis International - this May (Fisher, Luczynski, Machado, Lesser, Hood, Blowers, Pisman, & Vosters, 2015). We plan to submit these data for publication in the next couple of months to our field's applied flagship journal named the *Journal of Applied Behavior Analysis*.

- o Technology-enhanced Tutor-training Curricula: In last year's annual report, we reported that we published preliminary outcome data for the between-subjects comparison given the significant outcomes with four completed participants in both the technology-enhanced training and waitlist control groups (5-year Impact Factor, 2.665; Fisher, Luczynski, Hood, Lesser, Machado, & Pizza, 2014). Four additional participants have completed the evaluation, one test and three control participants, and two additional participants are currently enrolled. The results obtained with the additional participants replicated those obtained with the published results. Given that our primary focus at this point is producing outcome data on the effectiveness of our technology-enhanced in-home services for children with autism spectrum disorders (Experiment 3), we are not enrolling additional tutors for this aim unless a tutor is needed to provide in-home services for a child in Experiment 3
- o Technology-enhanced Early-intervention Services: For the randomized clinical trial, with the five dyads of children completed to date, relative improvements in the skills-based assessment domains for the children assigned to the technology-enhanced training group were observed for 3 of 5 dyads. When looking at the mean differences across groups, children who were assigned to the test group ($M = 43\%$) represented a larger improvement compared to the children assigned to the waitlist control group ($M = 27\%$). We have not yet observed robust, consistent differences between the children assigned to the test and control groups for the EVT; there was a larger increase from pretest to posttest for the PPVT. For the results regarding the Mullens Scale of Early Learning, an improvement from pretest to posttest for children assigned to the test group was observed for the fine motor, receptive language, and expressive language. However, the degree of improvement did not notably exceed that observed for the children assigned to

the waitlist control group. We look forward to re-analyzing the data after the sample size increases over the next year.

Reportable Outcomes

We presented the preliminary results of the randomized clinical trial for the technology-enhanced parent-training curriculum at our national conference this may, the Annual Conference of the Association for Behavior Analysis International. Please see the conference abstract below in Appendix 1. In addition, these data will be submitted for publication in the next couple of months.

Conclusions

The procedures of the technology-enhanced parent training (Experiment 1) and tutor training (Experiment 2) have reliably produced robust outcomes. Although the early results of the randomized clinical trial for the technology-enhanced child intervention services have promise, it is premature to draw any firm conclusions at this juncture of the award (Experiment 3).

References

- Fisher, W. W., Luczynski, K. C., Machado, M. A., Lesser, A. D., Hood, S. A., Lesser, A. D., Blowers, A. P., Pisman, M. D., & Vosters, M. E. (2015, May). *Preliminary results of a randomized clinical trial of a web-based program for training parents with a child with an autism spectrum disorder*. Paper to be presented at the 41st Annual Convention for the Association for Behavior Analysis International, Chicago, IL.

Appendix 1

See appended copy below of the conference abstract.

Names and Emails

Wayne W. Fisher (wfisher@unmc.edu),
Kevin C. Luczynski (kevin.luczynski@unmc.edu),
Mychal A. Machado (presenting author) (mychal.machado@unmc.edu),
Aaron D. Lesser (aaron.lessner@unmc.edu),
Stephanie A. Hood (stephanie.hood@briarcliff.edu),
Andrew P. Blowers (andrew.blowers@unmc.edu),
Meagan D. Pisman (maegan.pisman@unmc.edu), and
Megan E. Vosters (megan.vosters@unmc.edu).

Affiliation

Stephanie Hood: Briar Cliff University
Everyone Else: University of Nebraska Medical Center's Munroe-Meyer Institute

State and Country of Residence

Country: United States of America
State: Stephanie Hood - Iowa; Everyone Else - Nebraska

Citizenship

United States of America

Title

Preliminary results of a randomized clinical trial of a web-based program for training parents with a child with an autism spectrum disorder

Abstract

Estimates indicate that autism affects about 1 in 68 American children. Research has shown that *Early Intensive Behavioral Interventions (EIBI)* is effective when implemented by appropriately trained and supervised technicians. In addition to services provided by technicians, parents often contribute to their child's EIBI programming by extending teaching opportunities throughout the day. However, few empirically supported programs are available for training parents that include performance-based measures. We are conducting a randomized clinical trial to evaluate a 20-hour, web-based, E-Learning program for training parents in EIBI protocols. The two primary dependent variables are the *Behavioral Implementation Skills for Play Activities (BISPA)* and the *Behavioral Implementation Skills for Work Activities (BISWA)*. To date, 10 participants have completed pretest and posttest assessments on these measures, three in the treatment group and seven in the control group. Mean component skills implemented correctly on the pretest and posttest for the treatment and control groups for the BISPA were 4.0%, 6.1%, 89%, and 0%, respectively. For the BISWA, the results were 23.6%, 16.9%, 100%, and 27.3%, respectively. The results provide strong preliminary support for the efficacy of our web-based program, which can be delivered to parents anywhere in the world that has broadband Internet access.