Caregiver-Implemented Technology-Based Interventions of Children with Autism: A Research Synthesis

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OVERVIEW

We discuss results and implications of a synthesis evaluating the research on caregiver-implemented technology-based interventions for individuals with autism and other developmental disabilities. 14 studies were included. Interventions targeted a variety of outcomes, and most incorporated behavioral strategies (i.e., prompting, modeling, reinforcement). The most frequent interventions utilized were variations of video modeling and computer assisted instruction. Results indicate positive outcomes, with the average effect size of 0.71(0.27), ranging from 0.14 to 1.16.

RATIONALE

- Technology-based intervention and instruction for children with autism spectrum disorder (ASD) and other developmental disabilities (DD) are increasingly popular.
- While technology-based instruction presents its challenges, parents and teachers have also expressed that they find the use of technology-based instruction appealing and report using technology frequently with individuals with ASD and DD (King et al., 2017).
- Importantly, these devices should be considered a platform for delivering intervention, not the intervention itself, as technology can be incorporated into a variety of evidence-based teaching practices (Ledbetter-Cho et al., 2018).
- Technology-based interventions for individuals with ASD and DD have been successfully used to teach social, communication, and academic skills (e.g., DiGennaro et al., 2011; Pennington, 2010; Ramdoss et al., 2011).
- Families of children with developmental disabilities in rural and underserved areas may lack access to direct service providers.
- Global pandemics such as COVID-19 have further affected access to service providers for most children, often shifting services online and increasing the role of technology and involvement of parents and caregivers in intervention.
- Thus, there is a need to examine the characteristics and effects of caregiver implemented technology-based interventions for children with developmental disabilities.
- The review addressed the following research questions:
1) What are the characteristics of caregiver participants, child participants, settings, and interventions included in research evaluating caregiver implemented technology-based interventions for individuals with ASD and DD?
2) To what extent are caregivers involved in creating and implementing technology-based interventions for individuals with ASD and DD?
3) What are the outcomes of these interventions for individuals with ASD and DD?
4) How rigorous are studies evaluating caregiver implemented technology-based interventions for individuals with ASD and DD using criteria presented in Reichow et al. (2008)?

REFERENCES

References are available upon request. Please email Allie Cramer at armarques@crimson.ua.edu.

METHODS

ERIC, APA PsycINFO, Medline, and Psych and Behavior, were searched using terms related to autism and developmental disabilities, caregiver mediated interventions, and remote learning or technology-based instruction. Full search terms are available upon request. This search resulted in 1,432 articles, with 1,179 remaining after duplicates were removed.
- Articles were then screened at the title and abstract level to meet the following inclusion criteria:
    - At least 1 participant with DD (e.g., autism, intellectual disability) age 21 or younger
    - Parent or caregiver delivers intervention to child on electronic device
    - At least 1 dependent variable that is child's performance
    - Must utilize single-case experimental design
    - Published in the English language in a peer-reviewed journal
- 31 full text records were assessed to determine if they met inclusion criteria, resulting in 9 included studies. 5 studies were identified through an ancestral search. 14 total studies were included .
- Articles were coded, then double coded for the following:
    - Participant information
    - Caregiver information and training/support
    - Study design and dependent variables
    - Intervention dosage, procedures, device, and materials
    - Intervention outcomes and social validity
    - Quality indicators, strength of research
- Interrater Agreement ranged from 95.6% to 100%.

DISCUSSION

- Most studies had adequate methodological strength, yet four studies demonstrated weak methodological strength. These studies primarily lacked experimental control or had unstable or overlapping data. Thus, it is important to interpret the findings of this synthesis with caution.
- Most of the included studies demonstrated positive effects, further supporting the effectiveness of technology-based interventions. Additionally, findings of the current synthesis extend the evidence-base by providing promising evidence of treatment effects when mediated by caregivers (e.g., Ledbetter-Cho et al., 2018).
- When social validity was collected, caregivers, participants, and teachers all had positive experiences and comments, indicating these interventions may be socially acceptable.
- Results of this synthesis support that parents can independently create and implement technology-based interventions effectively without overly time intensive training.

LIMITATIONS

- Small number of studies (n = 14)
- Limited number of participants with DD (n = 4)
- Excluded gray literature
- Method of calculating effect size, as Tau-U does not provide a magnitude of change and strict benchmarks should not be used to interpret results (Vannest & Ninci, 2015).

FUTURE RESEARCH

- There is a clear need to strengthen the research base in this area through conducting quality SCEDs, particularly in establishing experimental control and stable data.
- Future research should include a focus on generality and fidelity of interventions, as well as on developing and describing feasible parent training procedures is needed, as several studies provided vague descriptions about training procedures and time involved.

IMPLICATIONS FOR PRACTICE

- Video modeling and computer assisted instruction most frequently resulted in positive caregiver fidelity and intervention outcomes. Behavior strategies (e.g., prompting and reinforcement) are important to incorporate in the intervention, as well.
- Practitioners are encouraged to recommend cost-effective, easily obtainable devices for use with caregiver implemented interventions (e.g., tablets, online applications). Provide comprehensive training packages (e.g., direct instruction, role play) and coaching prior to caregivers implementing technology-based interventions.

RESULTS

Citation	Skill Domain	Intervention Procedures; Dosage; Caregiver's Role in Intervention	Caregiver Training Procedures and Dosage
Acar et al. (2017)	Social skills	Intervention: Video Modeling; social praise Dosage: 5 times per week (up to 13 sessions per IV) Caregiver's Role: Provide video model; deliver social praise	Individual instruction from researcher on developing and implementing VM; included a written manual, PowerPoint, modeling, practice with role play *Dosage:* 2 weekends (1 IV per weekend)
Allen et al. (2015)	Community independence	Intervention: Video Self-Modeling; prompting across phases Dosage: 2 times per week (up to 27 sessions per skill) Caregiver's Role: Create video VM, instruct participant to view VM, and participate as store employee in simulated sessions	30-second tutorial on the VideoTote app *Dosage:* 30 seconds
Bernard-Opitz et al. (1999)	Correct vocal imitation	Intervention: Computer Assisted Instruction with mother or trainer; praise and occasional small edible for correct response Dosage: 20 minutes, 2 times per week for 10 sessions per IV Caregiver Role: Provide CAI and personal instruction (PI); CAI: Supervise, model sound (e.g., "Say, 'buh'"), provide praise and occasional edibles; PI: Hold toys, model sounds, provide praise and occasional edibles	NR
Besler & Kurt (2016)	Play skills	Intervention: Video Modeling; verbal praise Dosage: At least 3 times per week (up to 12 training sessions) Caregiver's Role: Create video model, provide initial cue and redirection to materials, social praise, and collect data	Individual instruction from researcher on developing and implementing VM; Included verbal, visual, and written material with examples, questions, and role play, practice sessions with feedback *Dosage:* 3 hours for 2 sessions; 6 total hours of training
Cardon (2012)	Imitation skills	Intervention: Video Modeling Imitation Training; error correction and verbal praise Dosage: 3 times per week (up to 14 intervention sessions) Caregiver's Role: Create video model, give turn cue, give verbal praise, and error correction	Instruction from researcher on developing VM and implementing VMIT; included training manual, effective and ineffective models, written instruction; live coaching and feedback in-home during first treatment session *Dosage:* 2 hours for 1 session
Cruz-Torres et al. (2020)	Daily living skills	Intervention: Video Prompting; error correction and social praise Dosage: 1 hour, 3 times per week (up to 17 hours) Caregiver's Role: Provide materials and initial cue; deliver error correction and social praise	Initial BST conducted individually by researcher; included PowerPoint, VM, live modeling, & rehearsal with feedback; Feedback in-home following each session *Dosage:* 2.5-4 hours for initial BST; 1-hour sessions in-home
Hampshire & Allred (2018)	Self-management skills	Intervention: Self=Management; prompting and reinforcement system Dosage: 2 times per week (up to 9 intervention sessions) Caregiver's Role: Monitor use of self-management system, provide prompting if needed, check-in with child and give feedback on completed homework, give "stars" as reward, provide reinforcers, take data	Training on ABA, self-management systems, data collection procedures, homework monitoring forms via direct instruction, intervention manual, and role play *Dosage:* 3 x 1-hour sessions; additional weekly coaching and support sessions if needed
Keen et al. (2007)	Toileting skills	Intervention: Video Modeling; prompting and reinforcement Dosage: 7 days per week (up to 79 treatment days) Caregiver's Role: Complete reinforcement survey, show child toileting video prior to sitting on toilet, provide reinforcement, provide prompting and redirection, check child's pants every 30 minutes	Informed about toilet training procedures and provided with written instructions *Dosage:* NR
Kim (2016)	Play skills and verbalizations	Intervention: Video Modeling Dosage: 5 minutes; 2 to 3 times per week (up to 13 intervention sessions) Caregiver's Role: Show video model, play with child, speak or demonstrate their portion of the script	Trained on scripted responses *Dosage:* NR
Litras et al. (2010)	Social skills	Intervention: Video Modeling; prompting provided on 4 sessions Dosage: 3 times per day (up to 17 intervention observation sessions) Caregiver's Role: Show video model, record data, provide prompting	Trained on observation and recording procedures; provided with instruction sheets for review as required *Dosage:* NR
Morgan & Miltenberger (2017)	Gun avoidance safety skills	Intervention: Video Modeling; prompting and praise Dosage: 3 times per week (up to 4 VM intervention sessions) Caregiver's Role: Restart video, provide prompting and praise	Coached prior to session; provided specific feedback after each session *Dosage:* NR
Sherer et al. (2001)	Conversational skills	Intervention: Video Modeling; verbal praise for on-task behavior Dosage: NR (Up to 28 VM using peer model sessions; up to 28 sessions VM using self-model) Caregiver's Role: Show video model, conduct generalization probes	NR *Dosage:* NR
Wang (2017)	Turn-taking and refusal behaviors	Intervention: Video Modeling Dosage: 13 minutes, 1 time each day for up to 9 intervention sessions (up to 1.95 hours) Caregiver's Role: Show video model, read book	Instruction from researcher on self-administration protocol procedure, practice, and assessment sessions *Dosage:* 1st intervention session
Whalen et al. (2006)	Language and social behaviors	Intervention: Computer Assisted Instruction Dosage: 15 minutes, Baseline: 1 time per week for 1-5 weeks; intervention data taken in 1st treatment session and 1- and 2-months post intervention (Up to 2 hours total) Caregiver's Role: Play with child, assist child with CAI	Given a binder with supplementary activities for software but no additional instructions *Dosage:* NR