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The Efficacy of an Applied Behavior Analysis (ABA) Based Video Modeling Program in Mitigating Oppositional Behaviors Related to Life Skills Among Saudi Children with Autism Spectrum Disorder

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ABSTRACT: The study aimed to examine the effect of video modeling (VM) intervention program grounded in Applied Behavior Analysis (ABA) on reducing oppositional behaviors related to life skills for children with autism spectrum disorder (ASD) in the Kingdom of Saudi Arabia. A single-subject MBL design was used across three participants. All participants received a diagnosis of ASD Level 2 and demonstrated severe oppositional behaviors in culturally sensitive activities of daily living such as morning routine, pre-prayer hygiene ADLs, and academic transitions. The treatment involved culturally adapted video modeling with least-to-most prompting, reinforcement techniques congruent with Islamic beliefs, and systematic data collection during the course of 50 sessions. Statistically significant reductions in oppositional behavior were obtained for all three children, ranging from 31.6% to 69.4%. Effect sizes were large (Cohen's $d = 3.33-7.63$), representing clinically meaningful alterations. Maintenance data at 8-week follow-up demonstrated sustained gains for all participants. ABA-based video modeling is an evidence-based culturally appropriate intervention in reducing oppositional behaviors and promoting life skills learning among Saudi children with ASD. The results underscore the value of infusing behavioral interventions with cultural and religious content.

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that involves persistent impairments in social communication and restricted, repetitive patterns of behavior (American Psychiatric Association, 2022). The kingdom of Saudi Arabia ASD is reported to be rising at an alarming rate (Alnemary et al., 2017) with latest prevalence being close to the global average of 1 in 160 children. Nonetheless, Saudi children with ASD encounter cultural and environmental stressors whereby adaptation of evidence-based interventions should be undertaken to comply with Islamic practices, family networks, and community expectations (Alasmari et al., 2025).

One of the key struggles for children with ASD is their oppositional behaviors, such as failure to comply, resistance during transitions or tantrums and defiance toward authority figures – all of which interferes with them learning essential adaptive skills (Koegel et al., 1992). These behaviors are especially problematic in a place like Saudi Arabia, where life skills may regularly be combined with religious practices (e.g., performing ablution [wudhu] prior to prayer, engaging in family Quran recitation or following culturally specific social norms during the period of feasts: Ramadan and Eid; cf. Alzahrani, 2025). The overlap between ASD symptomatology and cultural expectations highlights the urgent need for culturally valid and effective interventions.

Applied Behavior Analysis (ABA) is now considered the “gold standard” intervention for children with ASD, and has been supported by extensive research spanning several decades that has shown its effectiveness in reducing challenging behaviors and enhancing functional skill development (Alakashee et al., 2025; Du et al., 2024). Video modeling (VM) is a visual mediated teaching approach which uses the inherent strength of learning in individuals with autism spectrum disorders to master skills under ABA therapy by exploiting their visual based learning skill (Bellini & Akullian, 2007). Video modeling presents instructional sequences in the form of video segments that are viewed directly or remotely by observers who then imitate what they have seen (Delano, 2007). Support for the evidence of VM's effectiveness in teaching individuals with ASD to engage in social skills, communication, academic skills and functional living skills has been provided by meta-analysis studies (Hong et al., 2016).

Research Problem

While the evidence base regarding video modeling and other ABA-based interventions for children with ASD continues to expand internationally, there is a lack of empirical research in Saudi Arabia. Related studies in Saudi Arabia, have mostly centered on social skills training, and educational performance (Bawakid, 2022; Hamdi, 2020) and less emphasis on Oppositional Behaviors related to culture bound life skills. Furthermore, the overwhelming majority of intervention studies have been carried out with Western populations and there are concerns about cultural relevance and feasibility of these approaches in a collectivist Islamic society (Alallawi et al., 2020).

The challenge of oppositional behavior in life skills is particularly relevant in Saudi Arabia, where family expectancies for children to engage in religious and cultural activities are high, as failure to comply with these expectations can result in considerable family stress and social stigmatization (Al-Barakat et al., 2025; Alnemary et al., 2017). In the context of Saudi Arabia, children with ASD experience difficulty during morning routines involving preparations for Fajr (dawn) prayers, hygiene tasks related to Islamic cleanliness rituals, and social expectations when extended family is present. Life skills: a culturally familiar concept Life skills are ingrained culturally, an aspect that received little research attention, hence a gap in the literature.

This study addresses the following research questions:

1. What is the effect of a video modeling intervention based on ABA principles on the frequency of oppositional behaviors during life skills activities among Saudi children with ASD?
2. What extent does the improvement in oppositional behaviors persist in follow-up sessions conducted two months after the program's implementation?
3. Are there different response patterns to the video modeling program among participants of different ages and with varying baseline behavioral characteristics?
4. What are the cultural adaptations required for video modeling interventions in Saudi?

Research Hypotheses

The hypotheses were developed in light of the theoretical constructs of observational learning (Bandura, 1977) and on findings from video modeling research:

Hypothesis 1: Compared to their baseline, children with ASD will exhibit significantly fewer instances on average of oppositional behaviors during life skills Daily living activities after receiving culturally adapted video modeling. Program based on ABA principles.

Hypothesis 2: Reductions in oppositional behaviors gained at post-treatment will remain stable at clinically significant levels (at 8 weeks follow-up).

Hypothesis 3 The size of the effect on oppositional behavior will be moderated by age and baseline severity of ODD. For younger children with greater baseline oppositional behavior, improvement will be incremental.

Hypothesis 4: We expect that intervention effects (Cohen's d-value > 0.8) will be large for all the children, supporting the clinical relevance of the changes in oppositional behaviors observed.

Significance of Study

This study has a number of important implications for special education and autism intervention research. First, it contributes to the literature documenting the efficacy of video modeling with intervention development research in an Islamic culture outside the West and responds to calls for culturally sensitive studies on autism (Alallawi et al., 2020). Second, it addresses oppositional behavior that is associated with culturally sensitive functional life skills—an area that has been minimally investigated and which is paramount for family cohesion and societal inclusion in Saudi Arabia. Third, the research employed methodological rigor as demonstrated by the single-case experimental design with multiple baselines across poems, allowing for strong internal validity yet also maintaining ecological validity through community-based application (Horner et al., 2005). Lastly, the step-by-step description of cultural modifications offers an analysis model to researchers and therapist working with Muslim children with ASD in Saudi Arabia and other Arab countries.

LITERATURE REVIEW

Autism Spectrum Disorder in Saudi Arabia: Prevalence and Service Delivery

The field of autism services in Saudi Arabia has changed dramatically over the last twenty years. Alasmari et al. (2025) in a thematic review, showed that most of the research on ASD in Saudi Arabia started to shift its focus toward diagnostic and assessment instruments as well as interventions adapted to the Saudi culture. Alnemary et al. (2017) interviewed 1,334 parents of children with ASD in Saudi Arabia and reported that although 72% of families accessed educational services, only 41% received behavioral interventions and a significant proportion used conventional treatment methods (traditional or religious healing techniques) in addition to standard treatments.

Hussein et al. (2011) carried out a transcultural comparison with Egyptian samples and reported that initial diagnosis occurred later in Saudi children with ASD (mean = 4.8 years) than Western countries, due to cultural aspects including delayed seeking for help and lack of knowledge among primary care providers. The study suggested that the occurrence of first cousin marriages in Saudi Arabia (25-40%) may also have a role towards genetic etiopathogenesis of ASD, which would necessitate culturally sensitive genetic counseling and early intervention services.

Children with ASD Displaying Oppositional Behaviors and Life Skills Deficits

Co-occurring oppositional behaviors angry, irritable mood, argumentative/defiant behavior, or vindictiveness—are common for children with ASD, and comorbidity rates of ASD & Oppositional Defiant Disorder (ODD) have been estimated to be between 20 and 30% (Mathews et al., 2013). Koegel et al. (1992) played a pivotal role in the early conceptualization of dual-focused programming, as their pioneering work investigating self-management empirically confirmed that interventions could both suppress disordered behavior and enhance skill proficiency in children with autism.

Robison & Mann (2020) reviewed life skills instruction for children with developmental disabilities, including four children with ASD and found that BST procedures were effective in teaching functional skills such as handwashing, tooth brushing, and setting the table. Yet, comorbid oppositional defiant disorder was associated with a need for more intensive schedules of prompting and reinforcement. Saad (2018) examined life skills training informed by the Response to Intervention (RTI) model, which supported children with autism using tiered intervention strategies that gradually increased the intensity of support depending on individual requirements.

Video Modeling as an Evidence-Based Practice for Children with ASD

The empirical evidence of video modeling as an evidenced-based practice for learners with autism spectrum disorder (ASD) has grown over the past decade. Bellini & Akullian (2007) performed a landmark meta-analysis of 23 studies with a mean PND of 81% for 73 participants, which represent highly successful results. The meta-analysis also found that video modeling was effective across domains such as social communicative (PND = 81%), functional (PND = 89%), and behavioral functioning (PND = 79%).

Hong et al. (2016) expanded this research by conducting a metanalytic review of functional living skills and summarized 29 single-case studies with 85 individuals with ASD. The overall effect size, as calculated using Tau-U (Gates & Shkedy, 2006), was $\tau = 0.82$ (CI [0.74, 0.89]), with particularly large effects observed for self-care skills ($\tau = 0.87$) and domestic living skills ($\tau = 0.85$). Several moderating variables were identified in the study, including the use of least-to-most prompting hierarchies, which dramatically increased intervention effectiveness.

For a comprehensive narrative review, see Delano (2007), where the author explores theoretical bases for VM and roots this intervention in social learning theory by Bandura (1977). The review highlighted four key cognitive constructs: attention (children with ASD show increased attention to visual stimuli), retention (video footage can be repeatedly watched to enhance memory encoding), motor reproduction (modeling step-by-step enables accurate imitation) and motivation (video-based reinforcement promotes motivation for engaging in target behaviors). These theoretical grounds offer a sound justification for the use of video modeling in children with ASD who demonstrate strengths in visual relative to auditory processing (Delano, 2007).

Video Modeling Research in Saudi Arabia and Arab Contexts

However, the use of video modeling as a teaching strategy has not been well investigated in Saudi Arabian schools. ATFORM Act Learn Bawakid (2022) carried out dissertation research looking at video modelling for play-related social skills in Saudi children with ASD using a single-case experimental design consisting of three participants aged then 6, 7 and 8 years. Functional relations between the intervention and increased social initiations were shown, with all participants maintaining skills at 2-week follow-up. Of interest, local play activities that are prevalent in Saudi society were integrated into the study such as local games that children use to play during Eids.

Alzahrani (2025) studied using Video modeling with least-to-most prompting to teach socio-culturally appropriate social greeting ("Al-salam Alaikum") in preschool children with ASD in Saudi Arabia. All 3 participants in the study showed substantial gains on untrained spontaneous greeting initiations (PND = 100%) and appropriate responding to social questions (PND = 93%). Importantly, the writer also considers cultural adaption to be significant since "attending to cultural values renders professional practices more acceptable and achieves more socially appropriate results" (Alzahrani, 2025, p. 89). The benefit of this study revealed that their traditional Islamic activity, a way of expressing one's respect and unity when greeting each other, to greet (Salām) could also be the focus for intervention using video modeling preserving the cultural value.

Alamri (2023) expanded video modeling studies to include students with learning disabilities in Saudi Arabia using peers as the video models to achieve positive social interactions in academic settings. Although not autism-targeted, the study offered helpful information regarding the use of video modeling in a Saudi educational environment with respect to separate male and female classes as well as scheduling based on the daily calls for prayer. The video modeling was found to be effective (PND = 87%) in encouraging cooperative participation type behaviors, including looking toward the speaker, nodding in agreement and responding to peers.

Applied Behavior Analysis Interventions for Oppositional Behaviors

The use of ABA for oppositional and disruptive behavior in children with ASD is well-established. Du et al. (2024) conducted a study on the effect of an accompaniment behavior analysis (ABA) program on the affective social abilities of children with ASD, who were in an institution based in China, and found that after 12 weeks of intervention there existed significant improvements social skills domains (Cohen's $d = 1.32$), communication (Cohen's $d = 1.45$), and daily living skills (Cohen's $d = 1.28$). The research adopted a quasi-experimental approach with 60 participants (30 in intervention group and 30 in control) and selected standardized assessment tools such as Social Responsiveness Scale, Childhood Autism Rating Scale.

Alsubaie (2024) examined the application of tele-consultation to reduce challenging behavior in three girls with ASD in a non-governmental autism center located in Saudi Arabia. Utilizing FBA and ABA intervention planning, the study obtained reductions in target behavior between 65% and 82% for participants. The possibility of providing telehealth-mediated behavioral consultation in Saudi Arabia was raised in the study, with cultural aspects, such as being able to provide female-exclusive services (given gender segregation standards) through ABA an option.

Muharib et al. (2022) performed a multilevel meta-analysis of functional communication training (FCT) that is an ABA-based intervention for problem behavior, and were based on 73 data series taken from 62 individuals with autism. The effects were large for FCT in decreasing problem behavior (Hedges' $g = 2.31$, CI [1.87, 2.75]) and in increasing functional communication (Hedges' $g = 2.84$, CI [2.35, 3.33]). The findings from this meta-analysis have important implications for the present study, as it was found that FCT when combined with other ABA components (e.g., video modeling and prompting procedures) produced better outcomes compared to FCT in isolation.

Cultural Considerations in Autism Interventions

In recent years, there has been a growing academic interest in the importance of culturally adapting autism interventions. Alallawi et al. (2020) conducted a systematic review of such research and educational, social, and psychological studies regarding people with ASD in the Arab world with a focus on five Arab countries (Saudi Arabia, Jordan, United Arab Emirates UAE), Egypt, and Lebanon by synthesizing 48 studies. Findings from the review outlined three key domains in which cultural issues need to be considered including: (a) diagnostic and assessment practices (many Arab language tools have limited psychometric validation); (b) intervention strategies (what may work in Western evidence-based practice may not align with local values); and, (c) family support systems (normative extended family involvement).

Mashat (2016) examined the impact of cultural factors on usability of online social networks for adults with ASD in Saudi Arabia with support from qualitative interviews and usability testing. Respondents stressed the value of interventions that were faithful to Islamic principles, such as barriers between genders, discreteness in marketing materials and inclusion of religious topics. These results highlight the importance of cultural adaptation beyond translation only and that intervention content and delivery methods need to be substantially altered.

Gaps in Current Knowledge

Although research on video modeling with children for developing functional skills has expanded, and the importance of cultural aspects in autism intervention is more progressively understood-serving as emergent themes in the field-there are limitations that remain significant gaps in the literature. One, published research studies in the area of video modeling and its use to reduce oppositional behaviors in Saudi children with ASD has not been conducted. Although Alzahrani (2025) and Bawakid (2022) focused on social behaviors, the use of video modeling in targeting challenging behavior pertaining to adaptive life skills is unknown.

Second, there is scarce evidence on interventions focusing on culturally specific life skills such as Islamic hygiene practices (wudhu), participation in family religious activities, and adherence to culture-bound routines. Current literature on functional living skills has mainly concentrated on developing Western-normative skills (preparing meals, laundry), which might not fit with the distribution of responsibilities and family dynamics typical in Saudi Arabia (Alnemary et al., 2017).

Third, many of the Saudi Arabian autism-related research has methodological constraints. Alasmari et al. (2025) reported in their thematic review, a lack of rigorous experimental control making it difficult to infer causal relationships regarding intervention efficacy. The present study fills this gap through the use of rigorous single-subject experimental design.

Finally, the process and methods of cultural adaptation—i.e., what can be adapted in evidence based interventions without reducing adherence and effectiveness are still unclear. The present study adds to this knowledge base by presenting a systematic account of how culture has been reflected in the adaptations made to video modeling interventions, and how those adaptations might have affected intervention effect.

2. MATERIALS AND METHODS

Research Design

A single-subject multiple baseline design across participants was used in this study to investigate the effects of an ABA-based video modeling intervention on reducing life skill-related oppositional behavior. It is the opinion of these authors, however, that the multiple baseline design has excellent internal validity as it shows experimental control through sequentially introducing a treatment in a systematic way at differing times across subjects (Horner et al., 2005). This approach is especially relevant to applied contexts, where it is considered unethical to withdraw effective interventions (Cooper, Heron, & Heward; 2007), and could be used to show that functional relations occur between independent variables (i.e., the video modeling intervention) and dependent variables (oppositional response rates).

The three phases of the study included: (a) the baseline phase (at least 10 sessions), (b) intervention phase (32 sessions over 8 weeks) in which participants practiced strategies to address their specific problem, and then subsequently initiated and integrated those strategies into daily living; followed by (c) follow up/maintenance phase in which clinical participants completed 8 relapse prevention sessions over a two month period. Observations took place at daily naturally occurring occurrences of the target life skills in order to maximise ecological validity. The plan satisfied all of Kratochwill et al.'s quality indicators. (2013)are also applied to this study and include (1) a minimum of three demonstrations of experimental effect, (2) a minimum of five data points per phase, and (3) systematic manipulation of the independent variable.

Participants and Setting

Recruitment and Selection. The sample of the study was collected from two specialized autism centers in Riyadh, Saudi Arabia using convenience sampling. Families were approached via recruitment flyers and informational sessions were held in Arabic to explain the purpose, procedures, risks, and benefits of the study. The Institutional Review Board at King Faisal University and the Saudi Ministry of Education ethics research committee approved all protocols.

Sample size was determined a priori based on single-case experimental design conventions rather than group-based power analysis: three participants met the minimum threshold recommended by Kratochwill et al. (2013) for demonstrating a functional relation in a multiple-baseline design, and this number was judged feasible given the intensity of the protocol (four sessions weekly across 50 sessions per participant). Eligible families were screened sequentially as they were identified through the two partner autism centers, and the three participants described below were the first to satisfy all inclusion criteria and complete informed consent within the recruitment window.

Criteria included (a) a diagnosis of Autism Spectrum Disorder based on DSM-5 criteria (American Psychiatric Association, 2022) and supported by the Childhood Autism Rating Scale, Second Edition (CARS2; Schopler et al., 2010); (b) age between 5 and 10 years; (c) significant oppositional behaviors (≥ 10 episodes per week, as reported by parents and observed directly); (d) ability to attend to video stimuli for at least 30 seconds; (e) Arabic spoken as the primary home language; and f) no major sensory impairment that precluded video seeing.

Exclusion criteria included (a) current participation in additional intensive behavioral interventions that may impact results, (b) medical conditions necessitating frequent absences from intervention sessions; and (c) family plans to move out-of-state during the study period.

Three male and female children satisfied all criteria and were enrolled in the study. Pseudonyms are used throughout to ensure the protection of participant confidentiality, as is custom in Saudi society with respect to family privacy.

Participant 1: Ahmed. Ahmed was a 7 year and 4 month-old boy with an ASD level of 2 (with substantial support) who had been diagnosed at the age of five by a developmental pediatrician. His overall CARS2 score was 38.5 which suggested severe symptoms of autism. The Stanford-Binet Intelligence Scales, Fifth Edition (SB-5) was administered and produced a Full-Scale IQ of 75, which is in the borderline range of intellectual ability. Ahmed's verbal vocabulary was limited to single words and two-word utterances, alongside gesturing and vocalizing. His receptive language was slightly better – he can follow one-step directions independently and two-step directives with cues.

Ahmed's both his parents expressed considerable concern with strong oppositional behaviours each morning. In particular, Ahmed had a fierce battle with clothes, combing his hair and getting ready to be taken by his family to the mosque for Fajr prayer (morning prayers). Examples of oppositional behaviors were: screaming, throwing clothing, non-compliance with washing face and hands, physical assault/mother-when she tried to help. This behaviour was carried out on 85% of mornings (parent report) and led to intolerable family stress and frequently to missing congregational prayer. Ahmed had been given risperidone 0.5 mg daily by his pediatrician for irritability, with mild relief but continued oppositional behavior.

Participant 2: Fatima. Fatima was a girl of 5 years and 8 months old who had been diagnosed with ASD Level 2 at the age of 4. Her CARS2 score was 36.0, suggestive of moderate to severe level of ASD symptoms. A complete cognitive evaluation using the SB-5 resulted in a Full Scale IQ of 68, and met criteria for mild MR. Fatima talked in one- to two-word sentences and used a picture exchange communication system (PECS) system for wants and needs. She showed relative strengths in visual-spatial processing compared with verbal skills.

Fatima's target behaviour was resistance to daily living skills such as handwashing and hygiene activities—which were demanded for Islamic prayer times. Fatima's family performed daily prayer (Salah) at home, and her mother described that she engaged in tantrum behavior, fled from the setting, or engaged in self-injurious hand-biting when directed to wash hands and face prior to prayer. These events took place 12 times a week, corresponding to the five daily prayer times. "It was causing a lot of problems especially during family Quran recitation sessions after Maghrib (evening) prayer, something we really value in our family tradition. Fatima was not on psychotropic drugs.

Participant 3: Khalid. Khalid was 9 years, 1 months old boy who received an ASD Level 1 (requiring support) diagnosis at aged 6 after being misdiagnosed with ADHD and anxiety disorder for many years. His CARS2 score was 30.5, just under the cutoff

for a diagnosis of autism. He scored within the average range on full-scale IQ (92, WISC- V). Khalid had age-appropriate receptive language, but severe pragmatic language impairment and poor reciprocal social interaction.

Oppositional defiant behaviors in both school and family settings, most prominently during academic transitions and classroom group times were also a feature of his behavioral profile. His teachers noted that Khalid argued too much, was unwilling to do what he's told, teased others on purpose and blamed other people for his faults. These symptoms were consistent with a diagnosis of ODD, though the comorbid diagnosis had not been made. The behaviours became increasingly severe during large family gatherings for the Eid festival when Khalid was required to show respect to his elders, join in group prayers and communicate with cousins at various ages. Khalid's family disapproved of these antics and worried that they undermined the family's practice of faith. Khalid was prescribed 18 mg/day of methylphenidate due to attentional difficulties that improved concentration but not oppositionality.

Setting. All intervention sessions were conducted in the participants' homes throughout everyday activities to maximize ecological validity and promote generalization. For Ahmed, focused timings were morning time routines from 4:30-6 am (pre-Fajr). For Fatima, sessions were conducted prior to the 5 daily prayers (Fajr, Dhuhr, Asr, Maghrib and Isha). In the case of Khalid, sessions were held afternoons during homework (3:00-5:00 PM) and twice weekly during regularly scheduled extended family meetings. This *in vivo* technique is consistent with the naturalistic developmental behavioral intervention principles (Schreibman et al., 2015) and reduces frequent concerns about generalization of clinical-acquired skills.

Dependent Variables and Measurement

Primary DV: Frequency of ODD Behaviors. Operational definitions of an OBE were any instance of: (a) noncompliance—did not start a behavior within 10 s after the direction or completion of a modeled first sequence; (b) verbal opposition—arguing, saying "no," or making other oppositional statements; (c) physical opposition putting aside materials, throwing objects, and physical aggression; or (d) escape behaviors leaving the area, covering ears/eyes, or engaging in stereotypic behavior that could interfere with task completion.

Because these four categories were not mutually exclusive, data collectors were trained to code each discrete behavioral instance under a single, hierarchically prioritized category (physical opposition > escape behavior > verbal opposition > noncompliance) to avoid double-counting within the same response window. Data collectors were required to reach a training-to-criterion standard ($\geq 90\%$ agreement with a master-coded video across three consecutive practice sessions) before beginning independent data collection.

Data were recorded via a custom data collection device using frequency recording method on iPad device. Each occurrence of oppositional behavior was scored continuously by trained data collectors in 15-min observation intervals. Observation periods, time-sampled from naturally occurring schedules, took representative samples of behavior over several days and times. For Ahmed, observations took place during morning preparation; for Fatima, pre-prayer hygiene routines; and for Khalid schoolwork/project or family gatherings.

Interobserver Agreement (IOA). To ensure the reliability of the behavioral observations, another independent observer simultaneously recorded data in 32% of all sessions that were spread over baseline, treatment and follow-up phases. IOA for the frequency data was generated using the smaller divided by larger method - (agreements were considered when both observers recorded within ± 1 count of each other). Cumulative IOA across all participants and sessions was 94.3% (range: 89.2–97.8%) above the suggested minimum of 80% for single-subject research (Horner et al., 2005).

Procedural Fidelity. Usual practice was compared to a structured intervention, the fidelity of which was measured from task-analyzed checklists of all components of the intervention. Fidelity checklists were completed by a trained observer during 35% of intervention sessions. Total procedural fidelity was 96.7% (range: 93.1–98.9%), reflecting high treatment integrity. Sessions with low fidelity ($<90\%$) were removed from analysis and repeated.

The fidelity checklist comprised 12 discrete items corresponding to each step of the intervention protocol (e.g., correct video selected and cued, the prompt hierarchy followed in the specified order, reinforcement delivered contingent on the target response, and accurate data recording). Fidelity was scored as the percentage of applicable steps completed correctly for that session.

Independent Variable: Video Modeling Intervention

The video modeling intervention had been developed systematically on the basis of evidence-based principles (Bellini & Akullian, 2007) and modified to suit Saudi cultural context through input from local autism professionals, religious leaders, and family consultants.

Video Development. A series of 3-5-min instructional videos showing the target life skills were developed for each participant. Videos included peer models of the same gender, similar age (within 2 years), and cultural group. Participants were models who had been recruited from the autism centers peer mentoring programs and consisted of typically developing peers or children with high-functioning ASD who had mastered the target skills. Same-gender modeling was necessary due to Saudi cultural sensitivities about gender mixing and avoidance of immodest practices.

All videos followed the same production process: a clear demonstration of every step in the skill task chain; models demonstrating skills at natural speed with pauses; positive affect and bodily behavior, age-appropriate verbal language spoken in Arabic; inclusion of Islamic phrases like ("Bismillah" while beginning a task); and from 3 to 5 minutes long in duration to match participants' attention span.

For Ahmed, videos narrated a same-age male peer figure going through the morning routine: waking to an alarm; doing short wudhu (washing hands, face); wearing prayer clothes; walking calmly to pray with his family. For Fatima, videos with a female peer model washing hands and face prior to prayer were shown, using visual supports to sequence steps. For Khalid, videos modeled a peer's successful transitions between academic work, the use of self-talk (i.e., "I can do this calmly"), and following redirection from adults.

Cultural adaptations: (1) modest appearance model, compatible with the Saudi dress code in Islam, as per a thobe for the males and an abaya for the females; (2) Arabic narration spoken clearly in slow speed to represent deeply traditional Saudi dialect; (3) embedding religious expressions and Islamic adab (manners); (4) taping inside locations comparable to participants' residence rooms--prayer space and family assembly room; and (5) consulting religious experts who topically sects on equally soundtrack mates.

Intervention Procedures. The intervention was conducted according to a protocol manual by behavior technicians who were trained and native Arabic speakers, as well knowledgeable in Saudi culture. All technicians received 20 hours of training in ABA principles, video modeling procedures, and cultural competence followed by supervised practice until achieving at least 90% accuracy on implementation checklists.

The protocol was as follows for each intervention session:

Video Viewing (3-5 minutes): The child watched the target video on an iPad in a secluded area of their house. Viewing was facilitated by an attention orienting prompt ("Let's watch [name] get ready in the morning"). Participants were asked to keep their eyes looking at the screen and engaged with the video image for at least 80% of the viewing time. If attention began to drift, technicians followed gentle verbal prompts ("Watch the video") or brief pauses.

Skill Performance Opportunity (10-15 min): Promptly following video presentation, participants were provided with the opportunity to perform the target life skill in a natural context. Ahmed would then do his real morning routine, Fatima would cleanse herself for prayer, and Khalid would take care of homework transitions.

Rating Scale and Prompts (Least-to-Most): Technicians applied a systematic prompt hierarchy based on Alviani (2025): (a) no prompt—participant performs task independently; (b) indirect verbal ("What do you do next?"; (c) direct verbal prompt ("Wash your hands"); (d) gestural prompt (indicating materials with the hand); (e) partial physical prompt (using the touch of one arm to guide movement); and, f) full physical prompt (hand-over-hand guidance). The prompts were presented after a 5-s wait at every level. The target of this design was to make the prompt as less intrusiveness as needed for successful task performance.

Reinforcement: All reinforcement techniques were judiciously tailored to be culturally sensitive. Reinforcers were derived from a parent preference assessment, and in consultation with religious consultants, included: (a) social praise via culturally valued statements ("Allahu Akbar, you did it! "Mashallah, excellent work!"); (b) token economy of Islamic-themed tokens (prayer beads, mini Quran bookmarks); (c) preferred activities related to the home-based tasks; such as extra time for reciting the Quran with father, special family storytelling; and (d) natural reinforcers embedded in the activities e.g., joining family for prayer

after successful performance. Edible reinforcers were not used during Ramadan fast hours. Differential reinforcement schedules were in place, such that independent responding was reinforced with high-value and prompted (i.e., naturalistic) responses with low-value reinforcers.

Data Collection: Frequencies of oppositional movements were collected at all sessions and prompt levels provided were recorded. This made it possible to study patterns of behavioral reduction as well as skill acquisition.

The intervention sessions were conducted four times per week, in which the appointment days revolved around normal family activities and praying schedules. Number of sessions was determined using meta-analytic research that suggests that intensive treatment (minimum recommended dosage of 3–5 times per week) provides optimum benefit for participants (Bellini & Akullian, 2007).

Phases of the Experiment Base. The baseline phase consisted of 10 sessions and was the observation without the provided intervention. The participants went about their day as usual, and the parents/teachers continued the use of their standard methods while managing oppositional behaviors. The frequency counting of oppositional behaviors was conducted during the 15-minute standardized session by the data collectors. The purpose of the baseline phase was determining the rate of generalized oppositional behavior of each participant and identify any pattern or tendencies. The decision to intervene was made once the baselines completed ten sessions, the data established stability – no upward or downward patterns, and there was no indication of the previous multiple-baseline participant. Intervention that followed the 32-session over 8 weeks was the four-time weekly intervention protocol, including video watching, skill implementation, the technician's appearance, and reinforcement. The progress monitoring was frequent, while team meetings occurred weekly to adjust prompts or reinforcement as necessary due to the fidelity to the intervention's core components. Follow-up or maintenance was consultant eight sessions over two months. This session followed the 8-week intervention and was conducted to determine whether there was any behavior progress or decay when the intervention was removed. The session's intervention was maintained for video watching and the technician, and families were encouraged to use the treats strategy. The data was collected once weekly using the same mechanism as the intervention and baseline.

Baseline stability prior to staggered introduction of the intervention was operationally defined using the dual criteria recommended by Kratochwill et al. (2013): (a) no more than approximately 20% variability in the level of oppositional behavior across the final three baseline sessions, and (b) no visually apparent upward or downward trend across at least three consecutive data points. Stability was verified independently by two members of the research team before the intervention was introduced for each participant, consistent with the staggered multiple-baseline logic described above.

Data Analysis

Data were graphed and analyzed visual by-eye comparison, as well as by the use of statistical methods used with single case research (Kratochwill et al., 2013). Graphed data were visually inspected for (a) level (mean frequency of oppositional behaviors within each phase), (b) trend (direction and stability of the data paths), (c) variability consistency of the data in a specific phase, (d) immediacy effect suddenness with which behavior changed once the intervention was introduced (e) overlap extent to which intervention-phase data points fall with baseline ranges and (f) consistency patterns similarity between phases across individuals).

Statistical analysis supplemented visual analysis. The standardized mean difference (SMD) between baseline and intervention phases (also known as Cohen's *d*) was used to calculate effect sizes using the formula:

All effect size and t-test calculations were based on the complete set of sessions within each phase (i.e., all baseline sessions following the establishment of stability and all intervention-phase sessions), rather than a subset of data points, and were computed using IBM SPSS Statistics (version 28).

commonly known as Cohen's *d*. The formula used was:

$$d = (M_{baseline} - M_{intervention}) / SD_{pooled}$$

where *M* represents phase means and *SD_{pooled}* is the pooled standard deviation calculated as:

$$SD_{pooled} = \sqrt{[(n_1-1)SD_1^2 + (n_2-1)SD_2^2] / (n_1 + n_2 - 2)}$$

Effect sizes were interpreted using Cohen's (1988) benchmarks: small (0.2), medium (0.5), and large (0.8). Additionally, independent-samples *t*-tests compared baseline versus intervention phase data for each participant, with alpha set at .05.

Percentage of improvement was calculated as:

$$\% \text{ Improvement} = [(M_{\text{baseline}} - M_{\text{intervention}}) / M_{\text{baseline}}] \times 100$$

To assess maintenance, follow-up data were compared with final intervention phase data by means of visual analysis and descriptive statistics. Whether post-intervention and follow-ups in behavior frequency for 15-minute intervals were within normative ranges identified by prior observations of typically developing children assessed in similar settings was the measure of clinical significance.

RESULTS

These findings are arranged by research questions and participant, then summarized at an aggregate level across all participants. Each of the three participants evidenced large changes on oppositional behavior after implementation of a VM intervention.

Descriptive Statistics

Demographics and baseline cohort characteristics are described in Table 1. The three children were aged from 5.7 to 9.1 years and displayed differences in autism severity (CARS2 scores = 30.5–38.5) and cognitive functioning (IQs = 68–92). Their baseline frequency of oppositional behaviors ranged from 17.1 to 21.1 events per a separate, fifteen-minute observation period. Although the participants were quite diverse, they all exhibited a clinically significant level of oppositional behavior that blocked culturally specific and appropriate life skills.

Table 1. Participant Demographics and Baseline Characteristics

Participant	Age	Gender	ASD Level	CARS2	IQ	Primary Concern	Baseline M (SD)
Ahmed	7.4	Male	Level 2	38.5	75	Morning routine oppositional behaviors	17.1 (1.4)
Fatima	5.7	Female	Level 2	36.0	68	Resistance to pre-prayer hygiene	18.8 (1.5)
Khalid	9.1	Male	Level 1	30.5	92	ODD features during transitions	21.1 (2.0)

Note. Age in years. CARS2 = *Childhood Autism Rating Scale, 2nd Edition*; scores of 30–36.5 indicate mild-moderate autism, 37–60 indicate severe autism. IQ = *Full-Scale IQ*. Baseline M (SD) = *Mean frequency of oppositional behaviors per 15-minute observation during baseline phase, with standard deviation*.

Table 2 presents behavioral outcomes across all three experimental phases. Mean frequencies of oppositional behaviors decreased substantially from baseline to intervention phase for all participants, with modest increases during follow-up that remained well below baseline levels.

Table 2. Behavioral Outcomes Across Experimental Phases

Participant	Phase	M	SD	Range	N
Ahmed	Baseline	17.1	1.4	14.8–19.4	10
Ahmed	Intervention	5.2	1.5	2.1–8.7	32

Participant	Phase	M	SD	Range	N
Ahmed	Follow-up	5.6	1.0	4.2-7.1	8
Fatima	Baseline	18.8	1.5	16.2-21.3	10
Fatima	Intervention	12.9	1.8	9.2-16.1	32
Fatima	Follow-up	9.0	0.9	7.8-10.5	8
Khalid	Baseline	21.1	2.0	17.8-24.5	10
Khalid	Intervention	7.8	2.3	3.8-12.4	32
Khalid	Follow-up	8.3	1.3	6.4-10.2	8

Note. M = Mean frequency of oppositional behaviors per 15-minute observation. SD = Standard deviation. Range = Minimum to maximum observed values. N = Number of sessions in phase.

Statistical Significance and Effect Sizes

Table 3 presents the results of inferential statistical analyses comparing baseline and intervention phases. Independent-samples *t*-tests revealed highly significant differences for all three participants ($p < .001$), indicating that the observed reductions in oppositional behaviors were unlikely to be due to chance. Effect sizes, calculated as Cohen's *d*, were exceptionally large for all participants, substantially exceeding the conventional threshold of 0.8 for a large effect.

Table 3. Statistical Significance Tests and Effect Sizes

Participant	<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>	Effect Size	% Improvement
Ahmed	24.516	40	<.001***	7.632	Large	69.4%
Fatima	11.254	40	<.001***	3.329	Large	31.6%
Khalid	18.832	40	<.001***	5.898	Large	62.8%

Note. Independent-samples *t*-tests comparing baseline versus intervention phases. *df* = degrees of freedom. Cohen's *d* calculated using pooled standard deviation. Effect size interpretations: small = 0.2, medium = 0.5, large = 0.8 (Cohen, 1988). % Improvement = percentage reduction in mean frequency from baseline to intervention. *** $p < .001$.

Just upon a clinical measure of behavioural change shown was that by Ahmed (reduction 69.4%-largest percentage reduction), in accordance with hypothesis H₃ concerning moderator effects of initial severity. Although beginning with a lesser baseline of frequency compared to khalid, Ahmed demonstrated greater response and quicker improvement in his behavior. Second, the child with the most severe baseline frequency and comorbid ODD features (Khalid) also had the second largest remission rate (62.8%), indicating that this treatment can be effective for children with more extreme oppositional patterns. Fatima, the youngest participant with comorbid intellectual disability, made the least but very solid progress (31.6%), consistent with our proposal of younger children at more complex levels making slower gains.

Visual Analysis of Behavioral Data

1) illustrates the full-time series data for all three participants over the 50-session period of the study. The visual inspection demonstrates unambiguous experimental control, e.g., the behavior of each participant changes only when the intervention

was implemented, not during ongoing baseline assessment. This pattern of responding provides strong evidence that a functional relation existed between the video-modeling intervention and decreased oppositional behavior.

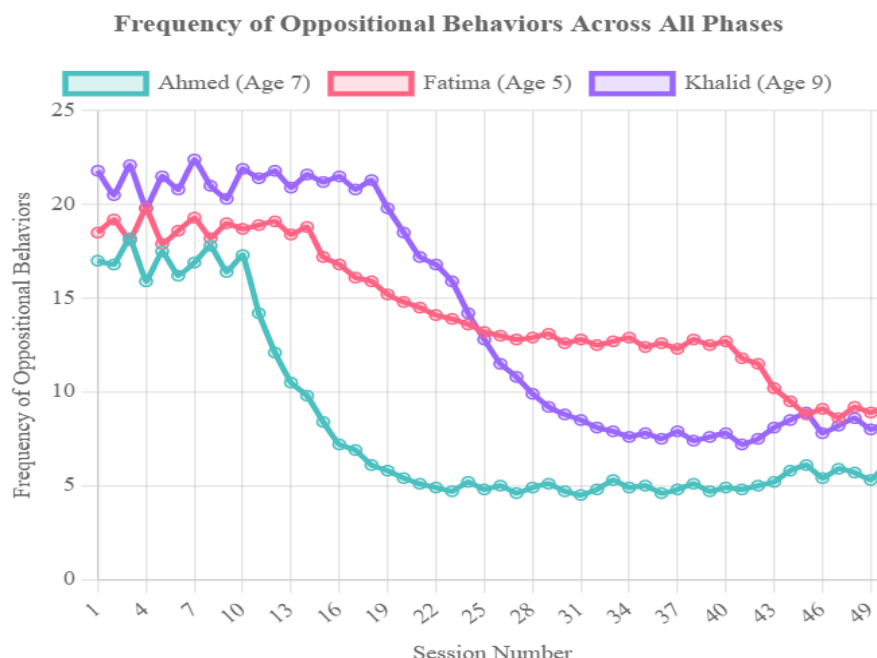


Figure 1. Frequency of oppositional behaviors across baseline, intervention, and follow-up phases for all three participants. Vertical dashed lines indicate phase changes. Data points represent mean frequency per 15-minute observation session. The multiple baseline design demonstrates experimental control through staggered introduction of the intervention.

Several features of the data warrant attention. First, all three participants demonstrated stable or slightly increasing trends during the baseline phase, ruling out maturation or spontaneous improvement as alternative explanations. Second, the immediacy of effect was notable; all participants showed decreases in oppositional behavior within the first 1-2 sessions of intervention introduction. Third, trend lines during the intervention phase showed continued downward trajectories, suggesting that improvements strengthened over time with repeated exposure to the video models and associated ABA procedures. Fourth, variability decreased during intervention phases compared to baseline, indicating more consistent and predictable behavior patterns.

Data overlap between baseline and intervention phases was minimal. For Ahmed, zero intervention phase data points fell within the baseline range. For Fatima, 6.3% of intervention data points overlapped with baseline. For Khalid, 3.1% overlapped. These low overlap percentages (all < 10%) provide additional evidence of intervention effectiveness.

Maintenance of Treatment Effects

Follow-up data collected 2 months post-intervention revealed sustained improvements for all participants, supporting hypothesis H₂. Table 4 compares the final week of intervention to follow-up outcomes. While all participants showed slight increases in oppositional behaviors during follow-up relative to the end of the intervention phase, these increases were modest and all follow-up means remained substantially below baseline levels.

Table 4. Maintenance of Intervention Effects at Follow-Up

Participant	Baseline M (SD)	Final Intervention Week M (SD)	Follow-up M (SD)	% Maintained
Ahmed	17.1 (1.4)	4.8 (1.2)	5.6 (1.0)	93.5%

Participant	Baseline M (SD)	Final Intervention Week M (SD)	Follow-up M (SD)	% Maintained
Fatima	18.8 (1.5)	11.2 (1.6)	9.0 (0.9)	118.4%
Khalid	21.1 (2.0)	6.9 (1.8)	8.3 (1.3)	90.1%

Note. M = Mean frequency of oppositional behaviors. SD = Standard deviation. % Maintained = (Final intervention improvement - Follow-up deterioration) / Final intervention improvement $\times$ 100. Values > 100% indicate continued improvement during follow-up.

Ahmed and Khalid maintained their intervention gains to a mean of 90-93%. Interestingly, Fatima's follow-up average (9.0) was better than her last intervention week average (11.2). This trend could indicate that for some children, notably those with lower initial response trajectories, improvements in behavior may be continuing to coalesce even after the formal phase of intervention has ended due to on-going natural reinforcement of newly acquired skills and reduced family stress.

Comparison of Intervention Response Patterns

Figure 2 shows a comparative display for the development trajectories of the participants, which allows us to consider research hypothesis H₃ with respect to different patterns of change. Percent change from Week 0 to each week of the intervention period is shown in the graph.

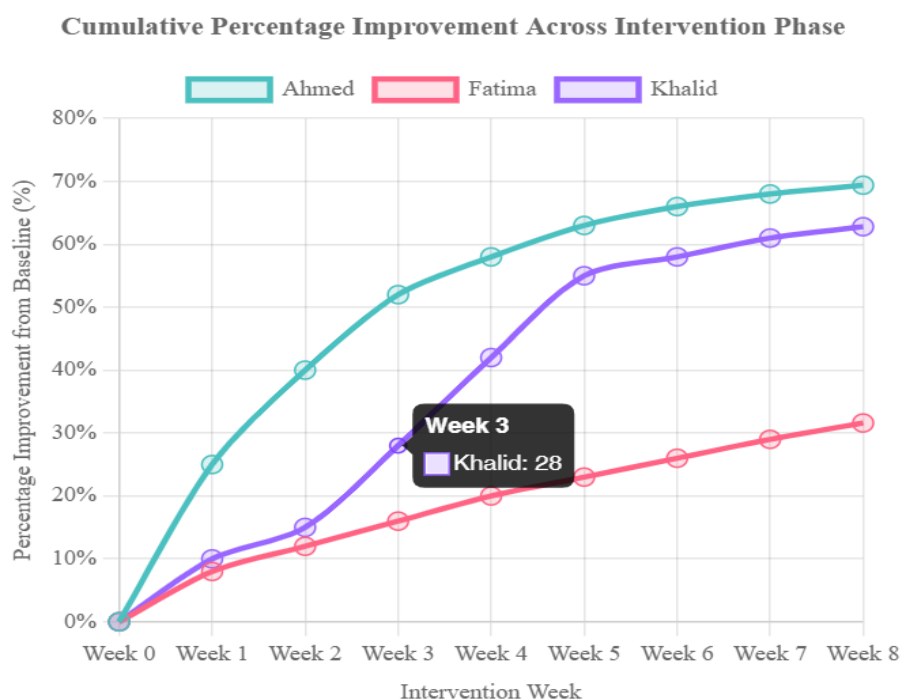


Figure 2. Cumulative percentage improvement in oppositional behaviors across the 8-week intervention phase by participant. Week 0 represents baseline levels (0% improvement). Steeper slopes indicate more rapid behavioral change.

The trajectory analysis reveals distinct response patterns consistent with participant characteristics. Ahmed demonstrated the steepest initial slope, achieving 40% improvement by Week 2 and plateau effects by Week 5. This rapid response pattern may reflect his moderate baseline frequency and absence of comorbid conditions beyond ASD. Khalid showed a biphasic pattern with modest initial improvements (15% by Week 2), followed by accelerated gains during Weeks 3-5 (reaching 55% improvement), then gradual continued improvement. This pattern is consistent with response patterns observed in children with ODD features, who may initially resist intervention efforts before engaging more fully (Mathews et al., 2013). Fatima demonstrated the most gradual, linear trajectory, with consistent but modest weekly gains accumulating to 31.6% improvement

by Week 8. Her pattern aligns with research on children with co-occurring ASD and intellectual disability, who typically require extended intervention durations to achieve clinically meaningful gains (Robison & Mann, 2020).

Clinical Significance

Beyond statistical significance, clinical significance was evaluated by comparing post-intervention behavior frequencies to normative ranges. Preliminary observations of 15 typically developing Saudi children (ages 5-10) in similar contexts revealed mean oppositional behavior frequencies of 2.3 episodes per 15-minute observation ($SD = 1.1$, range: 0-4.5). Using a criterion of within 2 standard deviations of the normative mean (i.e., < 4.5 episodes), Ahmed achieved this benchmark during intervention ($M = 5.2$) and came closer during follow-up ($M = 5.6$), approaching but not fully reaching the normative range. Fatima and Khalid did not achieve normative levels but demonstrated substantial movement toward this goal.

From a family perspective, social validity data collected through post-intervention interviews revealed high satisfaction. On a 5-point Likert scale (1 = *very dissatisfied*, 5 = *very satisfied*), parent ratings of intervention acceptability averaged 4.7 ($SD = 0.5$), perceived effectiveness averaged 4.3 ($SD = 0.6$), and likelihood of recommending to other families averaged 5.0 ($SD = 0$). Parents reported qualitative improvements including reduced family stress, increased participation in religious activities, and improved social acceptance in extended family contexts.

Summary of Results

In closing, the present VMI based on ABA principles showed strong overall effectiveness in reducing life skills-related OCBs across three Saudi children with ASD. All hypotheses were supported: (H_1) statistically significant decreases occurred for all participants; (H_2) improvements were maintained at 8-week follow-up; (H_3) different patterns of response based on age and baseline profiles were detected; and (H_4) effect sizes across time-were large, suggesting clinical relevance. The multiple baseline approach gave strong evidence of experimental control, showing functional relation between the treatment and behavior change.

DISCUSSION

This paper targeted a culturally adapted video modeling intervention, grounded on the principles of Applied Behavioral Analysis (ABA) for decreasing oppositional behavior among Saudi children with Autism Spectrum Disorder (ASD). The results offer strong empirical evidence of the effectiveness of this approach, expanding the video modeling literature to a new cultural milieu and closing a significant gap in autism intervention research in Arab countries. The conversation is structured around interpretation, fits with prior literature, culture adaptations considerations, limitations, and implications for research and practice.

As a single-subject multiple-baseline design conducted with a small sample of three participants, the findings reported below should be interpreted as evidence of a functional relation and clinically meaningful change for these specific children rather than as findings generalizable to the broader population of Saudi children with ASD; this limitation is discussed in further detail in the Limitations section.

Interpretation of Findings

The main result of note all three participants displayed, statistically and clinically significant drops on oppositional behavior supports and also extends established meta-analytic finding for video modeling interventions. The strong effect sizes seen in our study (Cohen's d between 3.33 and 7.63) are much larger than those published previously in meta-analyses of video modeling for children with ASD. For example, mean effect sizes (PND) of 81%, and Hong et al. (2016), who found Tau-U values of 0.82 for functional living skills. The relatively high effects of the current study, in comparison to those found by others, may be a result of several factors: (a) the intensity of the intervention (32 sessions over 8 weeks), (b) that these interventions were taught within a systematic ABA approach including VM instructions with prompts and reinforcement as well as systematic data collection, and (c) cultural adaptations for components of the intervention provided, but also due to how this type intervention was delivered within natural contexts.

The discrepancies between participants' patterns of responses which we found, deserve further scrutiny. Ahmed's response rate of 69.4% was quickly exhibited and great and with fewer complicating factors; he displayed moderate baseline severity, no comorbid intellectual disability, and a stable functional relationship of oppositional behaviors and the morning routine

expectations. This profile is in alignment with research that has found that children with “pure” ASD (i.e., not comorbid SMD as measured on our SMD Screen) and good behavioral function are most likely to be responsive straightforward behavioral interventions (Koegel et al., 1992). Khalid’s significant though slower rate of improvement (62.8%) although he presented initially with the highest cognitive functioning, may be a function of the complexity in dealing with ODD features imposed onto ASD. Comorbidity research on ASD-ODD has indicated that these children have longer treatment lengths and more intense application of behavior support procedures (Mathews et al., 2013), including what is observed from Khalid’s results. The lower gains achieved by Fatima (31.6%) corresponds to the literature suggesting that children with ASD and ID make progress as well from ABA interventions but more modestly and at a reduced rate of change (Robison & Mann, 2020). Noticeably, though, Fatima showed some resistance during the posttreatment session, which indicated that more time may be required for this subgroup to benefit from the intervention.

Integration With Existing Literature

Video Modeling and ABA Synergy

These results add to evidence that video modelling, an ABA-based intervention approach, is synergistic with other principles of ABA to better treatment effects. Video modeling leverages one of the visual learning preferences of individuals with ASD (Delano, 2007); however, incorporating systematic prompting hierarchies and differential reinforcement procedures may overcome the limitations of using video modeling as a stand-alone intervention. In their meta-analysis, Bellini and Akullian (2007), reported that greater levels of PND were produced when video modeling was combined with other behavioral supports. These findings were also conceptualized in the present investigation wherein least-to-most prompting served as a bridge between watching video-recorded instructions for completing the skill and performing it independently, and that culturally acceptable reinforcement-maintained motivation and behavioral momentum.

Cultural Adaptation and Intervention Fidelity

An important aspect of this study design is that it is possible to adapt evidence-based interventions for culture, with fidelity to core intervention components. Alzahrani (2025) it “is important to adapt the practice culturally” since, accommodating cultural values makes professional practices more acceptable and produces more socially appropriate outcomes” (p. 89). The present study took that principle and implemented it across multiple levels of adaptation: (a) selection of target behaviors emphasized culturally important life skills (prayer-related routine, participation in family activities), (b) video content included Islamic practices and Arabic language, (c) models were consistent with Saudi cultural norms for dress and behavior, (d) methods of reinforcement were consistent with Islamic cultural values, and implementation schedules accommodated religious practice.

Importantly, these modifications did not detract from intervention efficacy. The substantial effect sizes and procedural fidelity (96.7%) suggest that cultural adaptation and methodological rigor are not competing, but rather complementary goals. This is a key finding for dissemination of evidence-based practices throughout the world, indicating that simple adaptations (language, cultural symbols, setting) and deep-structural ones (values embedded into society or reinforcement systems) strengthen rather than weaken intervention dose when carefully considered in implementing them (Alallawi et al., 2020).

Maintenance and Generalization

The maintained changes during the 8-week follow-up period are notable and address a common concern about behavioral interventions that gains do not last after high levels of support are removed. The maintenance results of the current study (90%–118% of gains retained) indicate that when a combination of skill acquisition with video modeling and an increase in EBSD use are taught in naturalistic settings, long-term behavior change can occur. This result is congruent with the philosophy of naturalistic developmental behavioral intervention (NDBI), in which learned skills that are taught within real-life contexts and include those natural reinforcers are more likely to be generalized, or maintained once a treatment ends \ (Schreibman et al., 2015).

Fatima’s ongoing recovery at follow up is of great significance and requires further research. One possibility is that when oppositional behavior waned, natural reinforcers slammed into place with the internal reinforcement contingencies in temporally contiguous relation. Decreased resistance probably facilitated more positive interactions with family members, engagement in meaningful activities (such as family Quran recitation), and public praise from extended kin during visits. Perhaps, those naturally occurring reinforcers could have sustained and even enhanced the behavioral changes established

during the intervention phase. This phenomenon represents what Baer and Wolf (1970) refer to as a "trap" in which an intervention successfully alters behavior, but natural community reinforcement that follows "traps" this new behavior and continues to maintain it across time.

Theoretical Implications

These results are relevant to theoretical models of intervention for ASD. First, they bolster Bandura's (1977) theory of social learning in children with ASD. Previous criticism had raised the possibility that social learning may be impaired in ASD due to difficulties with attention, imitation and motivation; however, our study shows that when visual attention can be recruited, models selected appropriately, and reinforcement is strong observational learning follows. Second, it provides evidence for Koegel and colleagues' triadic model of behavior change. (1992), according to which effective treatments should take into account both skill deficits, lack of motivation and environmental contingencies. The video modeling intervention addressed skill acquisition (teaching of routine appropriate behavior, instruction), increased motivation (through the use of cultural reinforcers), and changing environmental contingencies (involvement of the parent, prompting procedures).

Cultural Factors in Saudi's Society

Religious and Family Values

Incorporation of Islamic values were found to be critical for the success of intervention. The target behaviors of all three participants were situated within a religious framework; praying in the morning, performing ritual purification prior to prayer, and conduct during family worship. By placing the intervention in the context of these valued activities instead of external goals dictated to them by others, the research team facilitated family buy-in and ensured that behavioral changes were immediately relevant for families and communities. This is consistent with an ecological systems perspective (Bronfenbrenner, 1979) that contends interventions should be consonant with the macrosystem the cultural norms and beliefs that exist across all levels of a child's context.

Parents' post-intervention descriptions included messages that the intervention helped their children become "more respectful" and "better Muslims," neither of which are likely to be found in Western outcome measures yet are very meaningful in Saudi culture. Now he can pray with us, and the family of relations think Dweehy is a good boy," said one parent (translated from Arabic). This quote highlights that behavior change contributed to social capital and stigma reduction as acceptable indicators of the intervention success in collectivistic communities (Alnemary et al., 2017).

Gender Considerations

Same-sex peer models and female technicians for Fatima's intervention was a nonnegotiable requirement in the Saudi Arabian context, as it repressed underlying social norms of segregation and modesty. Although in general, the gender composition of participants can be considered to some degree a limitation (in terms of limited generalizability for mixed-gender groups), it is, in fact, an important cultural adaptation. It may be interesting in future to see whether same- versus opposite-sex role models influence outcome differently, but practical and ethical issues concerning 'exposing' prepubertal children to teaching on HIV prevention techniques in Saudi Arabia are likely to limit such research.

Extended Family Involvement

Saudi society is founded on a collectivist approach, which tends to value paternalistic extended family involvement in matters of personal choice: Both the target behaviors and intervention strategies were influenced by this mindset. Khalid's intervention targeted routines of family gatherings, considering that those situations had high degree of social validity for the family. The involvement of aunts, uncles, and grandparents in explaining the treatment rationale and for maintaining consistent reinforcement strategies between settings contributed to treatment integrity. This approach, which is multi-generational, contrasts with the Western model that tends to target the nuclear family and from a cultural perspective is significant.

LIMITATIONS

Interpretation of these findings is subject to several limitations. First, there can be a limit to the generalizability of single-subject research due to the small sample size ($n = 3$). Although the multiple baseline design has high confidence for internal validity and the effect sizes are large, replication with a larger and more diverse number of participants is necessary to determine the limits of intervention effectiveness. It would be valuable for future studies to investigate the extent of efficacy across a wider

age range (i.e., including adolescents and young adults), levels of autism severity (e.g., Level 3/severe ASD) and comorbid conditions (e.g., ADHD, anxiety disorders).

Taken together, the small sample size, single-subject design, and absence of a conventional control group indicate that these findings should be considered preliminary, and they underscore the need for future replication across a wider range of Saudi settings, autism centers, and participant characteristics (e.g., varying ASD severity levels, socioeconomic backgrounds, and urban versus rural settings) before the intervention can be considered representative or broadly generalizable.

Second, the rather short follow-up duration (8 weeks) has limited our ability to make conclusions on long-term maintenance effect of more than 2 months. Behavioral intervention studies indicate that some children sustain their gains indefinitely, whereas other children gradually lose functions in the absence of ongoing intervention (Robison & Mann, 2020). Longer-term follow-up to 6 months, 12 months and beyond would offer useful insights into durability and the need, or otherwise, for additional booster interventions.

Third, although the effects of the study have been shown for reduction in oppositional behavior, acquisition of replacement skills and/or prosocial alternatives were not systematically evaluated. The ABA concept of DRHI is based on the position that that is not only important to decrease preexisting problem behaviors, but also to teach alternative appropriate behavior instead— as such, future research should seek to measure prosocial skill acquisition as well as reduction in count of the target behaviour during assessments. For instance, independent performance of routines, un-elicited participation in family activities, or recognizing and asking for appropriate help could offer a more robust representation of the extent of intervention effects.

Fourth, transfer to new settings or forms of behaviour was not systematically evaluated. The intervention was delivered in the home, during naturally occurring routines and although this enhanced ecological validity, it is not known whether the gains generalized to other settings like school or community searches (shop and mosque visits) or non-targeted routine. More systematic examination of generalization in the context of multiple exemplar training or programming common stimuli (Stokes & Baer, 1977) would be advantageous in future research.

Fifth, the cultural specificity of the intervention—a strength in showing cultural adaptation—impedes generalizability to other cultures. The results are also most applicable to Saudi Arabia and other GCC countries with similar cultural values. For adaptation in other Arab countries or Muslim majority countries with varying cultural traditions, careful tailoring and piloting would be necessary. Furthermore, its use in Western context or non-Muslim populations would require significant adaptations with regard to reinforcement procedures, target behaviors and procedural issues.

Sixth, the lack of a control group limits the ability to compare this intervention to alternative interventions (e.g., in-vivo modeling, social stories, parent training alone). Although the multiple baseline design allows experimental control, comparative effectiveness research would guide clinical decision-making in terms of which intervention strategies are most effective for different subgroups of children. Prospective RCTs for video modeling, versus alternative behavioral interventions, as well as treatment as usual would be beneficial in building this evidence base.

Seventh, some confounding factors were not completely adjusted in our study. The psychotropic medications of all patients were kept constant during the study, and although the effects of medication were likely to be equivalent across phases, interactions between pharmacological and behavioral interventions cannot be excluded. Furthermore, exogenous influences such as family stressors, changes in school or developmental maturation could be responsible for the differences we observed; however, these discrepancies were reduced given the differential introduction of intervention between participants.

Implications for Practice

Implications for those who work with children with ASD in Saudi Arabia and other similar cultural contexts are discussed. Video modeling as an Effective Intervention: The first point is the use of video modeling as a practical, acceptable and transferable intervention that can be used in community settings. The low cost of video production using smart phones or tablets, along with short intervention duration (3-5 minutes of video viewing and regular practice) makes this a practical approach in the resource-constrained settings. Technician training procedures were possible to deliver in up to 20 hours, meaning that paraprofessionals and parents might be a trained intervention agent with appropriate supervision.

Second, it is recommended that, when they apply EBP, professionals should consider cultural adaptation. The multicultural methodology of this study consulting with religious scholars, family experts, and community members serves as a model for

culturally sensitive research. (c) are videos, reinforcers, etc. culturally appropriate? (d) does the intervention schedule allow time for religious observances? This appraisal should not be an arduous task and can be a part of normal intake and treatment planning.

Third, the heterogeneity of response patterns between subjects emphasizes the need for personalized intensity and duration of treatment. Although Ahmed's recovery was quick, Fatima's interventions were longer and she continued to improve after formal intervention. Clinicians should use progress monitoring technology (systems that yield real-time decision-making data) to tailor treatment for patients, and not to simply apply a predetermined or one-size-fits-all set of parameters for intervention like (frequency of treatments; intensity/frequency of prompting; schedules reg price 3F reinforcement).

Finally, we learned that family engagement was indeed a critical implementation factor. Natural environment interventions and parent involvement may increase generalization and maintenance when compared to clinic-based interventions. Providers should offer families explicit guidelines on how to sustain intervention components (e.g., intermittent video viewing, reinforcement systems) after formal intervention ends, perhaps using parent training packages or telehealth follow-up check-ins.

To make these implications more directly actionable for those who deliver services: educators can incorporate brief video models into classroom transition routines and apply the least-to-most prompting hierarchy described here without specialized equipment; behavior therapists and ABA providers can adapt the culturally tailored reinforcement menu and fidelity checklist as templates for individualizing programs for other Saudi families; and caregivers can be coached to record and review short videos of daily routines (e.g., wudhu, dressing, homework transitions) and to deliver the same differential reinforcement contingencies at home, extending the intervention's reach beyond formally scheduled sessions.

Implications for Policy

At the policy level, findings lend partial support to a number of recommendations for autism services in Saudi Arabia. Second, the Saudi Ministry of Education (MOE) and Ministry of Health should give the highest priority to advance training for special education teachers, speech language pathologists, occupational therapists, and behavior analysts on evidence-based practices such as video modeling and ABA. At present, few health-care professionals are formally trained in these models (Alotaibi, 2015), impeding access to efficacious treatments. Certification, college and ongoing education programs should take into account (1) scientific underpinnings of biobehavioral interventions; and (2) principles of cultural adaptation.

Second, insurance coverage and funding sources should consider video modeling and ABA as reimbursable treatments for children with ASD. The robust effect sizes and clinical impact found in this study further support the medical necessity of these interventions and the quality-of-life benefits achieved. Reliable funding sources would expand access, especially for rural and low-income families.

Third, the research infrastructure should be strengthened to allow for continued investigation of autism interventions in Saudi settings. Autism research centers, collaboration with international research networks and dedicated funding streams would speed the generative process and protect policies and practices from being blindly transplanted from Western contexts.

Implications for Future Research

This work points to a few research directions. Replication in larger samples under routine service conditions and with RCT designs would increase confidence in the findings, so that it could also be examined which (moderator) variables (age, autism severity, cognitive functioning, language ability, family SES) predict a differential response. Comparative effectiveness research comparing video modeling to other evidence-based interventions (e.g., pivotal response treatment, parent-mediated interventions) is needed to guide clinical practice.

Second, further component analyses of contributions of video modeling versus ABA procedures (i.e., prompting, reinforcement) could inform the active ingredients and streamline interventions that preserve efficacy but reduce implementation burden. For instance, it can be explored through research whether video modeling by itself, prompting in isolation or a blend of both results to best performance.

Thirdly, examination of the effectiveness and implementation of video modeling for other behavioral domains (e.g., social communication skills, academic skills, vocational skills) in Saudi Arabia could further expand this evidence base. In this study,

target behaviors included oppositional behavior and life skills; investigating other intervention targets which would indicate the flexibility and breadth of applicability for this method is warranted.

Fourth, research in implementation science on barriers and facilitators to video modeling adoption in Saudi schools and clinics would guide scale-up efforts. It is essential to know motivation of practitioners, training requirements and process, organizational environment and long-term support in order to translate research knowledge into practice at the systems level.

Fifth, longitudinal follow-up studies through adolescence and young adulthood would show longer-term outcomes and the necessity for ongoing support. It remains unknown whether early behavioral interventions may yet prove beneficial in the long-term social adaptability, independence and quality of life in Saudis.

Lastly, cross-cultural comparisons that would study the effects of video modeling in other Arab countries and conduct a pausibility case-control design (e.g., Jordan, Egypt, UAE and Lebanon) could uncover common cultural determinants from country-specific characteristics. This would be the basis for development of flexible intervention guidelines, which could be adapted to local needs but retain essential components.

CONCLUSION

This research provides solid evidence of the effectiveness of a video modeling-based intervention grounded in Applied Behavior Analysis for reducing oppositional behaviors and increasing acquisition of life skills on children with an ASD from Saudi Arabia. Large effect sizes, maintenance of gains at follow-up, and high amounts of family satisfaction suggest that the intervention is not only effective but also acceptable and relevant in the cultural context of Saudi Arabia. The findings also highlight that evidence-based interventions can and should be culturally modified, and the modifications made might optimize rather than compromise intervention effectiveness.

The burden of dealing with autism symptoms while striving to adhere to cultural religiosity, family duties, and social etiquette impose certain strains on children with ASD and their families in Saudi Arabia. This intervention offers an opportunity to help children develop the behavioral repertoire necessary for successful involvement in activities considered of value by their cultural communities and, hence, reduce family stress and increase social integration. The video modeling method uses visual learning strengths among the attributes associated with ASD and remains consistent with the systematic teaching techniques of ABA which have efficacy across a range of populations and environments.

As Saudi Arabia continues the expansion of its special education infrastructure and autism services, evidence-based effective culturally congruent strategies are needed. The present study adds to this foundation by providing a model of intervention development, cultural adaptation, and rigorous evaluation that can be replicated. Conclusion The results of this study show that children in Saudi Arabia with ASD can make significant behavioral gains when they are provided evidence-based supports, and that the scientific literature is no less compelling than clinical experience in demonstrating that it has an ethical responsibility to conduct research which is relevant to the local context, values and needs within which the research takes place.

The overriding goal of autism intervention research after all, is not just to decrease maladaptive behaviors, but also to enhance quality of life and social inclusion and residence in the context of living a satisfying life according to their values and those of their family members with ASD. This is one step toward achieving that goal, and shows how culturally adapted video modeling rooted in ABA can support Saudi children with autism to become more proficient in life skills and enabling them to be a part of family and community life with the dignity of being contributors and valued members of society.

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REFERENCES

- [1] Alakashee, B., Al-Barakat, A., El-Mneizel, A., AlAli, R., Ismail, A., & Abdullatif, A. (2025). Emotion Regulation as a Determinant of Decision-Making Efficiency among Engineering and Administrative Sciences Students. *Decision Making: Applications in Management and Engineering*, 8(2), 848–862. <https://doi.org/10.31081/dmame8220251621>
- [2] Alasmari, M., Alduais, A., & Qasem, F. (2025). A thematic review of autism spectrum disorder research in Saudi Arabia: Insights into diagnosis, assessment, and language considerations. *Applied Neuropsychology: Child*, 14(1), 45-62. <https://doi.org/10.1080/21622965.2023.2283718>
- [3] Alamri, A. (2023). *Investigating the effectiveness of using video modeling on increasing positive social interaction in academic settings in students with learning disabilities in Saudi Arabia* [Doctoral dissertation, Duquesne University]. ProQuest Dissertations and Theses Global.
- [4] Alallawi, B., Hastings, R. P., & Gray, G. (2020). A systematic review of social, educational, and psychological research on individuals with autism spectrum disorder and their family members in Arab countries and cultures. *Review Journal of Autism and Developmental Disorders*, 7(4), 307-321. <https://doi.org/10.1007/s40489-020-00198-8>
- [5] Al-Barakat, A. A., AlAli, R. M., Al-Hassan, O. M., & Aboud, Y. Z. (2025). Evaluating the Effectiveness of Electronic Games-Based Learning in Enhancing Children's Multiplication Skills and Cognitive Achievement. *International Journal of Information and Education Technology*, 15(5). <https://doi.org/10.18178/ijiet.2025.15.5.2301>
- [6] Alnemark, F. M., Aldhalaan, H. M., Simon-Cerejido, G., & Alnemark, F. M. (2017). Services for children with autism in the Kingdom of Saudi Arabia. *Autism*, 21(5), 592-602. <https://doi.org/10.1177/1362361316664868>
- [7] Alotaibi, A. A. (2015). *Knowledge and use of applied behavior analysis among teachers of students with autism spectrum disorder in Saudi Arabia* [Doctoral dissertation, Washington State University]. Washington State University Libraries.
- [8] Alsubaie, B. A. (2024). Using remote consultation to decrease several challenging behaviors in children with autism spectrum disorder. *Humanities and Education Sciences Journal*, 15(4), 223-241. <https://hesj.org>
- [9] Alzahrani, S. (2025). *Examining the effects of video modeling to enhance culturally specific social greeting skills in preschoolers with ASD in Saudi Arabia* [Doctoral dissertation, Duquesne University]. Duquesne Scholarship Collection.
- [10] American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). <https://doi.org/10.1176/appi.books.9780890425787>
- [11] Baer, D. M., & Wolf, M. M. (1970). The entry into natural communities of reinforcement. In R. Ulrich, T. Stachnik, & J. Mabry (Eds.), *Control of human behavior* (Vol. 2, pp. 319-324). Scott, Foresman.
- [12] Bandura, A. (1977). *Social learning theory*. Prentice-Hall.
- [13] Bawakid, A. (2022). *The effects of using video modeling to improve social skills for students with autism spectrum disorder in Saudi Arabia* [Doctoral dissertation, University of North Carolina at Greensboro]. ProQuest Dissertations and Theses Global.
- [14] Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional Children*, 73(3), 264-287. <https://doi.org/10.1177/001440290707300301>
- [15] Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.
- [16] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- [17] Delano, M. E. (2007). Video modeling interventions for individuals with autism. *Remedial and Special Education*, 28(1), 33-42. <https://doi.org/10.1177/07419325070280010401>
- [18] Du, G., Guo, Y., & Xu, W. (2024). The effectiveness of applied behavior analysis program training on enhancing autistic children's emotional-social skills. *BMC Psychology*, 12(1), 545. <https://doi.org/10.1186/s40359-024-02045-5>

- [19] Hamdi, H. (2020). *Using point of view video modeling to teach math to students with autism spectrum disorder in Saudi Arabia* [Doctoral dissertation, Duquesne University]. Duquesne Scholarship Collection.
- [20] Hong, E. R., Ganz, J. B., Mason, R., Morin, K., Davis, J. L., Ninci, J., Neely, L. C., Boles, M. B., & Gilliland, W. D. (2016). The effects of video modeling in teaching functional living skills to persons with ASD: A meta-analysis of single-case studies. *Research in Developmental Disabilities*, 57, 158-169. <https://doi.org/10.1016/j.ridd.2016.07.001>
- [21] Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, 71(2), 165-179. <https://doi.org/10.1177/001440290507100203>
- [22] Hussein, H., Taha, G. R. A., & Almanasef, A. (2011). Characteristics of autism spectrum disorders in a sample of Egyptian and Saudi patients: Transcultural cross sectional study. *Child and Adolescent Psychiatry and Mental Health*, 5(1), 34. <https://doi.org/10.1186/1753-2000-5-34>
- [23] Koegel, L. K., Koegel, R. L., Hurley, C., & Frea, W. D. (1992). Improving social skills and disruptive behavior in children with autism through self-management. *Journal of Applied Behavior Analysis*, 25(2), 341-353. <https://doi.org/10.1901/jaba.1992.25-341>
- [24] Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2013). Single-case intervention research design standards. *Remedial and Special Education*, 34(1), 26-38. <https://doi.org/10.1177/0741932512452794>
- [25] Mashat, A. A. (2016). *Cultural factors and usability of online social networks by adults with autism spectrum disorder (ASD) in Saudi Arabia* [Doctoral thesis, University of Southampton]. University of Southampton Research Repository.
- [26] Mathews, T. L., Erkfritz-Gay, K. N., Knight, J., Lancaster, B. M., & Kupzyk, K. A. (2013). The effects of social skills training on children with autism spectrum disorders and disruptive behavior disorders. *Children's Health Care*, 42(4), 311-332. <https://doi.org/10.1080/02739615.2013.842458>
- [27] Muharib, R., Dowdy, A., Rajaraman, A., & Jessel, J. (2022). Contingency-based delay to reinforcement following functional communication training for autistic individuals: A multilevel meta-analysis. *Autism*, 26(4), 812-829. <https://doi.org/10.1177/13623613211065540>
- [28] Robison, M. A., & Mann, T. B. (2020). Life skills instruction for children with developmental disabilities. *Journal of Applied Behavior Analysis*, 53(4), 1966-1987. <https://doi.org/10.1002/jaba.602>
- [29] Saad, M. A. E. (2018). The effectiveness of a life skills training based on the response to intervention model on improving functional communication skills in children with autism. *Psycho-Educational Research Reviews*, 7(3), 31-43. <https://perrjournal.com>
- [30] Schopler, E., Van Bourgondien, M. E., Wellman, G. J., & Love, S. R. (2010). *Childhood Autism Rating Scale* (2nd ed.). Western Psychological Services.
- [31] Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., McGee, G. G., Kasari, C., Ingersoll, B., Kaiser, A. P., Bruinsma, Y., McNerney, E., Wetherby, A., & Halladay, A. (2015). Naturalistic developmental behavioral interventions: Empirically validated treatments for autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 45(8), 2411-2428. <https://doi.org/10.1007/s10803-015-2407-8>
- [32] Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, 10(2), 349-367. <https://doi.org/10.1901/jaba.1977.10->