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PIXELS OR PEOPLE: A COMPARISON OF THE DIFFERENITAL EFFECTS OF ANIMATED AND HUMAN VIDEO MODELS ON EXERCISE BEHAVIORS FOR HGH SCHOOL STUDENTS WITH INTELLECTUAL DISABILITY

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THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Applied Behavior Analysis in the
College of Education
at the University of Kentucky

By

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ABSTRACT OF THESIS

PIXELS OR PEOPLE: A COMPARISON OF THE DIFFERENITAL EFFECTS OF ANIMATED AND HUMAN VIDEO MODELS ON EXERCISE BEHAVIORS FOR HGH SCHOOL STUDENTS WITH INTELLECTUAL DISABILITY

Individuals with intellectual disabilities, with or without autism spectrum disorder, often require structured programming to facilitate acquisition of skills. Video modeling, an evidence-based strategy, offers a promising avenue for skill instruction. While research has demonstrated the effectiveness of human-modeled video interventions, limited research has been conducted into the efficacy of animated models. Addressing this gap, the present study employed an alternating treatments design to compare the effectiveness of human and animated models in teaching exercise behaviors to high school students with intellectual disabilities, with or without autism spectrum disorder. Results revealed variability among participants: one individual exhibited superior performance with a human model, another with an animated model, while no significant difference was observed for two participants. These findings contribute to understanding the applicability of different modeling techniques in interventions for individuals with intellectual disabilities with or without autism spectrum disorder.

KEYWORDS: Video Modeling, Intellectual Disability, Autism Spectrum Disorder, Animated Model, Exercise, Alternating Treatments Design

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4/25/24

Date

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DEDICATION

To my family, who has shown me unwavering support throughout my graduate experience. Thank you, Mom, for always being a call away and for being my rock. To my Dad, who sends me endless support, ensuring I am always safe and taken care of. To Jasmine and Julie, my sisters, who have shaped me into the person I am today and have loved me every step of the way. To my grandparents who constantly check in on me, and to Maw, who was not able to see me graduate. I love you all and could not have done this without every single one of you. Thank you.

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Introduction

In recent years, there has been an increased prevalence of developmental disabilities such as autism spectrum disorder and intellectual disability. Autism spectrum disorder, or ASD, involves challenges in social interaction, communication, and restricted and repetitive behaviors. Intellectual disability, also known as ID, includes specific challenges in cognitive abilities and various skills like understanding concepts, interacting socially, and managing self-care tasks such as personal care. Given these challenges in both disabilities, it is crucial to provide effective educational and therapeutic programming, often guided by evidence-based strategies. One of these strategies is video modeling (VM), rooted in the social learning theory developed by psychologist Albert Bandura. Bandura demonstrated that children acquire a diverse range of skills by observing others perform them, rather than solely through personal experience. He also discovered that people imitate behaviors, whether reinforcement is present, and apply them in settings beyond where they were first observed (Bellini, 2007). This technique of modeling has been applied to technology, which led to video modeling (VM). Video modeling is where a person models a behavior or skill. Video modeling has proven effective in instructing individuals with ID and ASD, covering a variety of skills such as social skills (Bellini & Akullian, 2007; Litras et. al 2010; Tetreault & Lerman, 2010), play (Hine & Wolery, 2006), academic skills (Jowett et al. 2012), and self-help skills (Moore et al. 2013; Rayner, 2010; Shrestha et al. 2013). Building upon the efficacy of VM in addressing the challenges of ASD, research has delved into comparing various subjects for modeling (Park et. al 2019).

Research has explored various subjects used as models within VM including peers, siblings, adults, or self as a model. A meta-analysis by Bellini and colleagues (2007) analyzed 22 studies with 69 participants analyzing social-communication skills, functional skills, and behavioral functioning domains. Their findings revealed that VM and video self-modeling interventions exhibited comparable effects in treatment, maintenance, and generalization across outcome variables (Bellini et al., 2007). In addition, VMs can be filmed from either first-person or third-person point of view. First-person point of view is where the camera or recording device captures the scene as if the viewer is experiencing it directly or from the viewpoint of an individual. Third-person point of view is where the camera or recording device records the scene from an external perspective, detached from the personal experience of an individual. Research has analyzed which point of view is most effective. Ayers and colleagues (2007) compared both types of point-of-view modeling to see which was most effective in teaching students how to put away groceries. They found that there is no clear differentiation of superiority of one type of video model over another (Ayers & Lagone, 2007). To support their conclusions, Sherer et al. (2001) compared video self-modeling to third-person modeling and reported no significant differences, suggesting the inclusion of learner preference in determining the filming perspective for video models.

Current research is exploring the idea of taking learners' interests into the model, specifically, a hero to that learner. This is termed video hero modeling, where preferred individuals or objects demonstrate skills. This form of video modeling can utilize animated or human models. Prior research has suggested that the use of animated characters is more appealing, therefore learners will have increased engagement even though it is not empirically supported because of the limited research on this topic. Ohtake and colleagues (2015) used animated action figures to teach bathroom-related behaviors (drying hands, arranging shoes, covering buttocks, and tucking shirt). Results showed that all four targeted behaviors increased due to the implementation of the animated video hero model (Ohtake & Takahashi, 2015). Subsequent research aimed to assess the effectiveness of animation in video modeling, regardless of alignment with individual preferences. This exploration holds significance considering technological advancements, particularly the accessibility of AI-generated characters, which enables flexibility in modeling types. However, limited studies have explored whether animated models that are not tailored to learners' preferences effectively instruct skills to individuals with intellectual disabilities.

Studies investigating animation's effectiveness have shown promising results. Fujisawa et al. (2011) compared animated images versus static images to determine their effectiveness in skill acquisition and found animated cues more effective than static cues at teaching symbols used in Augmentative and Alternative Communication (AAC) for individuals with intellectual disabilities. Research has been conducted to investigate the efficacy of using animation in teaching daily living skills. Drysdale and colleagues (2014) examined whether adding animated elements to a video could teach toileting skills, specifically the ability to eliminate in the toilet. They utilized animation to depict a urine stream entering the toilet and assessed whether two children with ASD could successfully eliminate in the toilet after the animated intervention. The study demonstrated the effectiveness of animation in teaching toileting skills (Drysdale et al., 2014).

Yalçın et al. (2023) expanded on this by utilizing animated models to teach daily living skills. Researchers used an animated-based teaching package on the acquisition of three daily living skills for three middle school students with intellectual disabilities. The animated model was either a male or female-presenting young adult who modeled sandwich preparation, brewing tea, and pouring tea. All three participants had high rates of correct steps of the culinary skills following the instruction given by the animated actors. This study strengthens the rationale to use animated actors as effective video models (Yalçın, et al. 2023). Additionally, Kellems and colleagues (2020) examined if animation is an effective tool for teaching social skills. He used a live animation avatar to teach participants how to "start a conversation". After the introduction of the animated model that used a social-skills intervention, all participants reached typical mastery levels and conversation skills generalized to interactions with same-aged peers (Kellems et al., 2020). In a subsequent publication, Kellems et al. (2022) also tested the effectiveness of an avatar versus human model in social engagement with elementary-aged kids with ASD. Participants had two alternating conditions, (1) a series of interactions with adults and (2) a series of interactions with live animation avatars. Data demonstrated that all participants were more attentive during social interactions with the avatar versus the human.

Considering the growing utilization of technology in education and therapy, the exploration of animated models' efficacy in video modeling is timely. While both human and animated models show promise in skill acquisition, understanding their relative effectiveness is essential. Thus, this study aims to examine what are the differential effects on independent and accurate performance of exercise behaviors when using video models with an animated actor versus a human actor for high school students with ID with or without ASD?

Method

Participants

Four high school students with ID, with or without ASD, aged 16-17 years old participated in the study. See Table 1 for each participant's demographic information. Inclusion criteria were assessed via direct observation through informal assessment in which participants were shown two to five videos depicting up to five gross motor movements and asked to imitate the videos. All videos shown during screening were unrelated to the VMs used in the study. All participants met the study's inclusion criteria based on their abilities to (a) attend to a task for at least 5 minutes, (b) attend to a video for at least 2 minutes, (c) independently imitate 4- to 5-step VMs, (d) perform basic gross motor skills required for exercises, (a) has not missed more than 10 days in the school year, (b) has adequate vision with or without glasses, and (c) free of medical conditions that would inhibit comfort exercising (e.g., frequent seizures). Also, all participants had their own touchscreen phones and attended physical education class at school during the study. All guardians of participants consented, and participants assented to participate in the study.

Table 1

Participant Information

Participant	Age	Race	Documented Gender	Diagnosis	IQ^	Adaptive Behavior Scale^
1- Kite	16	Asian	Male	Autism- Mild/Moderate[a]	43[b]	43[c]
2- Tengen	17	White, non-Hispanic	Male	Intellectual Disability	49	51
3- Maki	16	Asian	Female	Autism- Severe[a]	57	46
4- Power	16	Hispanic	Female	Autism- Severe[a]	64	54

Note. ^Assessment scores reflect participants' most recent school evaluation for special education services. *a- CARS 2;* [b]Stanford Binet- X ed. (Fulkerson et al., 1997);

Researchers

The lead researcher in this study was a white female master's student pursuing her applied behavior analysis degree. The secondary researchers were a white female master's student pursuing her applied behavior analysis degree and one white female BCBA-D. All researchers were overseen by a white female BCBA-D.

Setting

The exercise sessions took place in a designated section of the school gymnasium, equipped with all necessary materials, and a prepared iPad to display the VMs.

Researchers preloaded the participant’s exercise schedules an app, which embeds video models into a video activity schedule, onto the iPad and placed the iPad within an iPad stand prior to the start of each session. These sessions were scheduled during the initial 15 minutes of the gym class, leveraging the free time in which general education peers transitioned into workout attire. This period served as an effective warm-up, setting the tone for the subsequent gym activities.

To maintain data accuracy, one to two researchers positioned themselves behind and to the side of the participants during observations, ensuring the data sheet was oriented away from the participant’s view. The designated section in the gym was an upstairs track area and could not be seen from the main gym floor, thus mitigating the risk of observational learning.

Also, to address the potential influence of adaptation effects, researchers were in the classroom for two months preceding the study. This approach aimed to acclimate the participants to the researchers' regular presence.

Materials

The exercise schedules were provided via the *Choiceworks* (Bee Visual, 2011) mobile application on one ninth generation Apple iPad in a protective case with a handle and a flip stand. These iPads were placed on an iPad stand so the iPad could be viewed at eye level when standing. Before each session, the researcher activated the Choiceworks application, where they pre-selected the designated exercise schedule based on a prior randomization. To randomize, researchers put number 1-3 in a list generator, and pressed randomize for the fixed number of sessions. Researchers referenced a randomization table used in previously published literature comparing two interventions. Additionally, they configured the randomized order of the exercise tasks within the selected exercise schedule. At the start of every session, the application was already launched, displaying the exercise schedule. The application interface featured a screen exhibiting three distinct photos arranged in a vertical column, each corresponding to a specific exercise (see Appendix A). Above each photo, a label denoted the exercise's name. Upon selection, each exercise photo seamlessly linked to a video resource. These videos were comprised of an animated VM for one exercise, a human VM for another, and a control video for the third exercise. The control video presented only the name of the exercise, followed by a black screen lacking a video model. After the VM played, be it the animated VM, human VM, or control video, the application transitioned back to displaying the exercise schedule. Following this, participants executed a simple drag-and-drop action, moving the exercise photo associated with the completed video to a second column labeled "All Done." Subsequently, participants selected the next exercise in accordance with the predetermined schedule.

Video Models

Animated Video Models

Eight videos were downloaded from the YouTube channel, Little Sports (Little Sports, 2019). The videos consisted of a male-presenting and female-presenting animated young adult doing various combinations of exercise movements. The full downloaded videos were spliced apart, isolating 16 different exercise movements. Researchers categorized these movements into three domains: leg/arm (LA), cardio (C), and core (K). Once each exercise movement was placed into a category, researchers paired two exercise movements from each category together (e.g., 10 reps of X followed by 10 reps of Y were a single exercise video in the LA category within the schedule of exercises).

After pairing, researchers edited the videos. First, the original audio was removed, and researchers replaced it with an upbeat workout song, "Playful," located in the iMovie app. Researchers added a title screen that appeared for four seconds that had the name of the exercise. In addition, researchers added an end screen that said, "Good Job!!" The exercise movements were slowed down about 50%, per research that reported learners with intellectual disabilities performed better with slower-speed videos (Biederman et al., 1999). The VMs lasted approximately 1 min 0s to 2 min 59s minutes in duration.

Human Video Models

After editing the animated videos, researchers filmed human video models by imitating the animated model. This consisted of a human model that imitated the exercise movement and the speed of the movements. The human video model consisted of one woman standing in front of a plain, brown wall, completing all exercise movements. Then, researchers edited the videos. The original audio was removed, and researchers replaced it with an upbeat workout song, "Playful," located in the iMovie app. Researchers added a title screen that appeared for four seconds that had the name of the exercise. In addition, researchers added an end screen that said, "Good Job!!" The VMs lasted approximately 1 min 0s to 2 min 59s in duration.

Control

Researchers added a title screen that appeared for four seconds that had the name of the exercise. A black screen was presented for 55 seconds, while an upbeat workout song, “Playful” played, which was located on the iMovie app. In addition, researchers added an end screen that said, “Good Job!!”

Experimental Design

An alternating treatments design (ATD; Ledford & Gast, 2018) with a comparison phase and replication phase was used to compare the differential effects on independent and accurate performance of exercise behaviors when using video models with an animated actor versus a human actor. In the comparison condition, each variation of the independent variable (i.e., animated and human VMs) was applied to its set of assigned exercises in a randomized order for a randomly assigned set number of sessions (between 7 and 10) for each participant. Each session consisted of one trial of an animated VM, one trial of a human VM, and one trial with a control version (i.e., task direction only, no VM). The ongoing control condition was included to detect maturation or history threats. The exercises assigned to each participant, and the version of the VM (animated, human, or control) assigned to each exercise, were counterbalanced across participants to help control for sequence and carryover effects (see Table 3). Then it was verified from a university professor who has experience in conducting studies using an ATD. Researchers included a best alone condition to confirm that participants will perform at their most accurate performance of exercise behaviors with only one independent variable applied. If their responding is lower than what was observed in the intervention, or if there was a change during the control phase, we can assume that there was multi-treatment interference. In the ATD, there is a preset condition length to compare the differentiation within the set condition, in addition to reduce bias from researchers.

The biggest limitation of an ATD is ensuring that each condition is of equal difficulty. To ensure that each condition was equal, a minimum of two blind raters performed the exercises and were interviewed to see if any seemed easier or harder. Due to the rapid switching of conditions, another threat was instrumentation (e.g., human error, observer drift, etc.). This was controlled by having researchers take procedural fidelity in at least 20% of the sessions and providing researchers with a “cheat sheet” with critical features of the intervention to be implemented for each session.

Dependent Variable

A list of all 12 exercises organized by exercise domain and their operational definition can be found in Table 2. Each participant encountered animated, human, and control versions for each exercise. In a session, they followed an exercise schedule comprising one leg/arm, one cardio, and one core exercise, each with an animated, human, or control version. Exercise and version assignments were counterbalanced across participants, with three unique schedules per participant (see Table 3).

The dependent variable was the count of accurately preformed exercise repetitions. For each exercise, the actor demonstrated 2 moves, with 10 reps of each move, totaling 20 reps of each exercise (e.g., for the leg/arm category, the actor would do 10 reps of punches followed by 10 reps of victory squats; see Table 2). Data were collected on the accurate imitation of each repetition during the exercise for a maximum of 20 repetitions. A repetition was considered correct if (a) its topography matched the operational definition (see Table 2), and (b) it was initiated within the duration of the video model displaying the move, or (c) it was initiated within the 55 s for control exercises that did not have a VM. For exercises presented with the control version (i.e., a task direction to complete the exercise without an edited or unedited VM), data were collected on any repetitions aligning with the exercise performed for all. If a participant indicated they did not know what to do or were finished, they could move on to the next exercise in their schedule. If the control video ended and the participant did not check the schedule within 10 s, the researcher provided a prompt to check their schedule. Each session resulted in three data points: the count of correctly performed exercise moves for the animated VM, the count of correctly performed exercise moves for the human VM, and the count of correctly performed exercise moves for the control exercise.

To clarify questionable instances of exercise behaviors when training on data collection, there was a confederate who exhibited questionable instances of the behavior. This allowed all researchers to ask questions and understand when to score correctly and incorrectly. There were task analyses listed beside the name of the exercise so researchers could ensure the participant's topography matched the TA.

Table 1

Exercises by category with move operational definitions

Category	Exercise Label	Exercise Name	Move Operational Definitions
Leg/Arm	LA1	Punches + Victory squats	*Punches:* Take one hand and punch across body, bring back, take other hand punch across body *Victory Squats*: Squat, bring one arm above head,twist body opposite side, stand

			up, squat, bring other arm above head, twist body opposite side
	LA2	Arm crossovers + Hip swirls	*Arm crossovers:* Stand up straight, take both arms and cross in front of body, horizontally extend arms, take both arms and cross in front of body *Hip swirls:* Arms extended horizontally, lift one knee up, bring outside the body, back down, lift other knee up, bring outside the body, back down
	LA3	Body extensions + High knee jacks	*Body extensions:* Arms reaching towards the sky, arms down to knees, squat, stand up arms reaching towards sky *High knee jacks*: Arms reaching towards sky, lift one leg up, bring both arms under lifted leg, return to beginning, lift other leg up, bring both arms under lifted leg
	LA4	Arm circles + Lateral taps	*Arm circles:* lift one arm up above head, bring the same arm down, lift other arm up above head, bring the same arm down *Lateral taps*: Start in a squat with feet together, extend one foot out to the side and tap your toe on the ground, bring that foot back to start, extend the other foot out to the side and tap your foot on the ground, bring that foot back to start
Cardio (C)	C1-	Lateral arm circles + Ski hops	*Lateral arm circles*: Bring one foot back to split stance, rotate arms in circle, feet together, take other foot back to split stance, rotate arms in circle, stand up *Ski hops*: Knees bent arms at side, jump to one side (laterally) and bring arms up

		above head, land and bring arms down, jump to opposite side (laterally)
C2-	Hand claps + Forward jumps	*Hand claps*: Stand with hands at side, step to the side, bringing legs together and clapping overhead, step to the other side, bring legs together and clap overhead
		Forward jump: Swing arms down and behind your back, jump forward with both feet, stand straight up, rotate a half turn, jump forward with both feet
C3-	Hopscotch + Running man	*Hopscotch:* Elbows bend with hands at head, jump, put one foot behind opposite leg, bring back, jump, put other foot behind opposite leg
		Running man: Hands in fists at side, bring both arms to one side, outside arm straight out and inside arm bent, jump and put one foot back, return to beginning, rotate arms to the other side, outside arm straight our and inside arm bent, jump, and put the other foot back
C4-	Ski jacks + Side lunge windmill	*Ski jacks:* One arm up one arm down, one leg up one leg back, jump and switch
		Side lunge windmill: Knees bent, trunk of body parallel to the ground, looking down, one hand touches opposite foot while other reaches to the sky, return to beginning, other hand touches opposite foot while opposite hand reaches towards the sky

Core (K)	K1-	Side bends + windmill	*Side bends*: Hands on hips, raise one arm up, bend body opposite direction, hands on hips, raise other arm up, bend body opposite direction *Windmill*: Arms extended horizontally, take one hand and touch opposite foot, stand up, take other hand and touch opposite foot
	K2-	High step march + body rotations	*High step march:* Bring one leg up to hip level, use opposite hand to touch toe, return to standing, bring other leg up, use opposite hand to touch toe *Body rotations*: Arms horizontal, twist shoulder and trunk so you are looking to a side, return to beginning, twist shoulder and trunk so you are looking towards other side
	K3-	Knee raises + Side pinchers	*Knee raises:* Stand up straight with arms extended above head, hands clasped together, bring arms down towards one leg, bring that leg up to hip level, bring body back to hands above head, clasped, bring arm down toward other leg, bring that leg up to hip level *Side pinchers:* one hand on hip one above head, lift the leg that is on the same side of the extended hand out and to waist level, bring the extended arm down, trying to touch elbow to the leg, go back to standing straight up, but the opposite hand on hip and the other hand extended above head, lift the leg that is on the same side of the ended hand out and to waist level, bring that extended arm down, trying to touch elbow to the leg

	K4-	High knee chips + diagonal abs	*High knee chops:* Stand up straight with feet a shoulder width apart, arms bent at the elbow, hands at your head, lift one leg up to hip level, bring opposite elbow down, touching your knee, return to starting position, lift other leg up to hip level, bring opposite elbow down, touching your knee *Diagonal abs:* Hands at shoulder height or above, legs hip width apart, lean one hand toward floor, move torso up and then back down

Table 3

Counterbalancing of Exercises and VM Versions Across Participants

	Leg/Arm Exercises				Cardio Exercises				Core Exercises			
	1	2	3	4	1	2	3	4	1	2	3	4
Participant 1												
Schedule 1	A				H				C			
Schedule 2		H				C					A	
Schedule 3			C					A				H
Participant 2												
Schedule 1	H				C					A		
Schedule 2		C					A				H	
Schedule 3				A				H				C
Participant 3												
Schedule 1	C					A				H		
Schedule 2			A				H				C	
Schedule 3				H				C	A			

Table 3,

Continued

Participant 4									
Schedule 1			C	A			H		
Schedule 2	A				H			C	
Schedule 3		H				C			A

Note. This table depicts the counterbalancing of exercises included in each schedule for each participant and the counterbalancing of the VM version (animated, human, control) presented for each exercise across participants. A refers to the animated version of the VM. H refers to the human version of the VM. *C* refers to the control video.

Procedures

General Procedures

Each condition began with the researcher preparing the upstairs track area of the school gymnasium. During the first session, Power repeatedly left the exercise area. As a solution, researchers introduced a yoga mat during the second session as a visual boundary and stimulus prompt, guiding Power on where to stand and workout. A model was given to all researchers of how to align materials, so it was consistently arranged each session. The researcher prepared the iPad and all materials to take data (e.g., clipboard, pencil, data sheets). The iPad had the exercise videos on the app ChoiceWorks already programmed into it, they will choose the specific exercise schedule for that day, as noted in the dependent variable and Table 2. Once everything was arranged correctly, each participant was taken to the upstairs track area of the gym. The researcher ensured that the participant was attending to the iPad by checking if the participant's body or eyes were orientated to the iPad, then provided a task direction to the participant to "Check their exercise schedule."

Researchers praised every 30s regardless of whether the participant was engaging in correct or incorrect behaviors to keep participants engaged and motivated. Based on prior observation and reports made by the lead teacher, participants will disengage from completing an activity if there is no praise being given. Researchers did not provide any prompts on how to perform the exercise or praise on correct or incorrect steps. Once the first exercise finished, the participants stopped their exercise movements, said they were not sure what to do, or provided no response for 10 s, they moved on to the next exercise. If they did not slide the video to "finished" within 10 seconds, provided a prompt (verbal or model) to proceed. This continued for all three exercises. After completion, general praise such as, "Thanks for coming to exercise! "You're getting strong!" was given. If planned, researchers compared data for inter-observer agreement (IOA) and assessed procedural fidelity (PF).

Comparison Condition

This condition followed all general procedures. After the participant was told to "Check their exercise schedule," they navigated the ChoiceWorks app and touched the first workout, which automatically played the video. The researcher stood to the side of the participant with their datasheet away from the participant, watching the participant and collecting data on the behaviors as they related to the task analysis. The participant went through all three videos following the general procedures.

Best Alone

A best alone condition was administered once the participant completed all sessions. This consisted of the participant doing one of their previously assigned control exercises with the independent variable that resulted in the highest number of independent exercise repetitions (e.g., accurate repetitions were consistently higher in the human condition, therefore they completed one control exercise that they had never seen with a human doing the exercise). If there was no difference in the independent variables, participant preference was collected. Researchers provided printed pictures of both models and asked the participant to choose which one they preferred to watch while exercising. Participants could point to their selected model or vocalize their response by naming the picture. The selected model was used as their best alone condition. The condition was procedurally similar to the comparison condition, the only difference being that only one exercise was completed.

Interobserver Agreement

Two master's students and one university professor were trained to mastery on all procedures, including data collection. The training had in-vivo sessions where confederates performed the exercises listed, and two researchers took data on the confederates' behaviors. The training continued until researchers reached 100% IOA agreement for three consecutive trials.

IOA was collected for at least 20% of the sessions in all conditions and needed to score at 80% agreement or above for each participant in each condition following What Works Clearinghouse (WWC) guidelines (Kratochwill et al., 2010). If IOA fell below

80% agreement for any reason, sessions were temporarily paused, and all researchers underwent another training session until mastery was achieved again. To calculate IOA, researchers used a gross agreement by dividing the smaller count of accurately performed exercise repetitions by the larger count of accurately performed exercise repetitions (Gast et. al 2014) and then multiplied by 100 to calculate a percentage of agreement. IOA results are located in Table 4.

Table 4

Overall Percentage of Interobserver Agreement

Participant	Overall % of sessions	Animated	Human	Control
1- Kite	25%	70%-100%	100%	100%
2- Tengen	25%			
3- Maki	22%			
4- Power	30%			

Procedural Fidelity

Two master's students and one university professor were trained to mastery on all procedures, including data collection. The training had in-vivo sessions where confederates performed the exercises listed, and one researcher took data on the researcher's implementation behaviors. During each session, fidelity data were collected on the following research behaviors. Before sessions, the researcher ensured (a) the correct exercise schedule was selected and reset on the app, (b) the exercise order aligned with predetermined randomization, (c) the iPad volume was adjusted, and (d) all exercise materials were arranged. Within sessions, the researcher behaviors included (a) providing the task direction, (b) refraining from prompts or praise during each VM, (c) providing general praise every 30 s, (d) ensuring the trial continued until the video ends or the participant exits, (e) limiting prompting of the use of technology unless necessary after 10 s of inactivity from the participant, and (f) offering general praise at the session conclusion (refer to Appendix B). The training continued until researchers reached 100% P for 3 consecutive trials.

PF was collected for at least 20% of the sessions in all conditions and needed to score at 80% agreement or above for each participant in each condition. If PF fell below 80% agreement for any reason, sessions were temporarily paused, and all researchers underwent another training session until mastery was achieved again. PF data were determined by dividing the total number of correct researcher behaviors by the expected researcher behaviors, and then multiplying the quotient by 100 (Gast et al., 2014). PF data were recorded for the following behaviors across all conditions and participants: (a) correct materials available in set locations, (b) iPad in set location and set up correctly, (c) correct task direction provided, (d) no unprogrammed prompting provided, (e) given 10 s per step to complete the navigation steps, (f) given allotted total duration to imitate VM (duration varied based on environment), (g) provided general praise at the end of session. Overall, PF data were collected in 25% of sessions for Kite at 100% fidelity, 25% of sessions for Tengen at 100% fidelity, 22% of sessions for Maki at 100% fidelity, and 30% of sessions for Power at 100% fidelity. Procedural fidelity was 100% across all conditions and participants.

Results

Visual analysis (Gast & Spriggs, 2018) was used to determine the effectiveness of each video modeling condition (animated and human models) and to see which was the superior video modeling treatment. Researchers analyzed by looking at each condition in isolation and assessed level, stability, and variability, then used a point-by-point analysis to analyze each intervention condition's effectiveness in comparison to the control condition, then used a point-by-point analysis to analyze all three interventions at the same time to determine the superior treatment. The superior treatment was determined by the majority (greater than 50%) of comparison sessions in which one IV resulted in 10% more independent repetitions. For example, if a participant had eight predetermined comparison sessions, at least five sessions needed to have one IV (e.g., human model) which resulted in two more accurate repetitions than the other IV (e.g., animated model). Overall, one participant demonstrated differentiated higher independent responding with the human VM, and one participant did not show differentiated responding between the two conditions. Data collection in the comparison condition is ongoing for two additional participants.

Kite's data are displayed in Figure 1. Kite's independent exercise repetitions exhibited a moderate to high level of responding in the human condition, with high variability. Conversely, during the animated condition, Kite's responding varied from low to moderate levels, with high variability. The control condition maintained a 0% stable level of responding throughout the entire duration of the study. Comparing the human to the control condition, using a point-by-point analysis, the human condition was higher than the control condition for all eight data points. Comparing the animated condition to the control condition, the animated condition had higher responding for seven data points. Using a point-by-point analysis in which all three sessions were compared, the human condition had a higher level of responding compared to both conditions for 8 out of 8 sessions (100% of sessions), therefore, the human condition proved to be superior for Kite. This demonstrated that the human condition was an effective intervention while the animated condition was a moderately effective intervention.

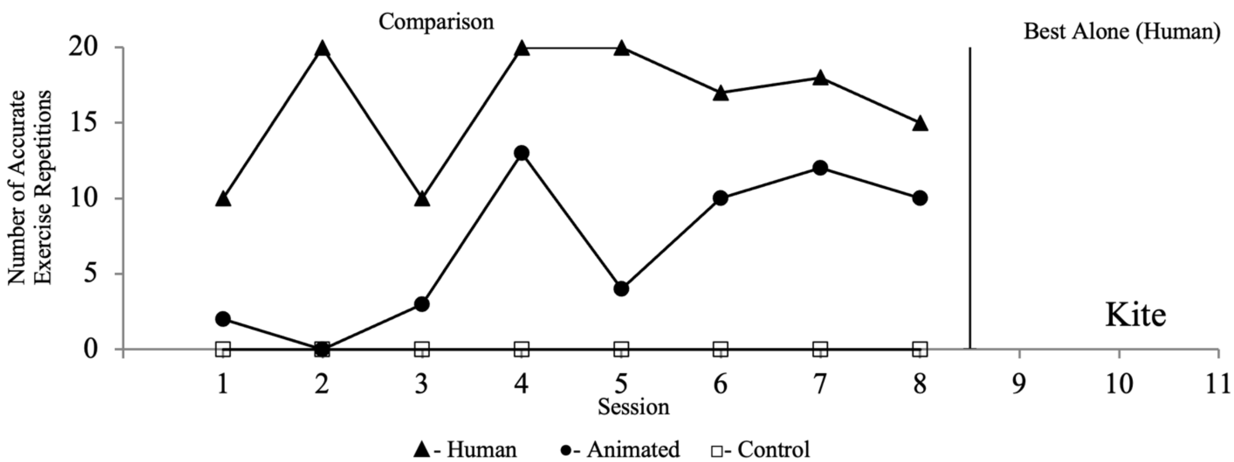


Figure 1 *Results for Kite*

Tengen’s data are displayed in Figure 2. Tengen's human data exhibited a low to high level of responding, with high variability. Additionally, during the animated condition, Tengen's responding varied from low to high levels with high variability. The control condition maintained a 0% stable level of responding, except for session seven where responding was at a low level, at 10%. Comparing the human to the control condition, using a point-by-point analysis, the human condition was higher than the control condition for six data points. Comparing the animated condition to the control condition, the animated condition was higher for six data points. Using a point-by-point analysis in which all three sessions were compared, two sessions showed higher responding in the human condition, two sessions displayed higher responding in the animated condition, and there was no difference in the remaining sessions. Therefore, neither condition was a superior condition for Tengen. This demonstrated that the human condition and the animated condition was a moderately effective intervention for this participant. As both independent variables proved moderately effective, researchers allowed Tengen to choose which condition he preferred for his best alone condition.

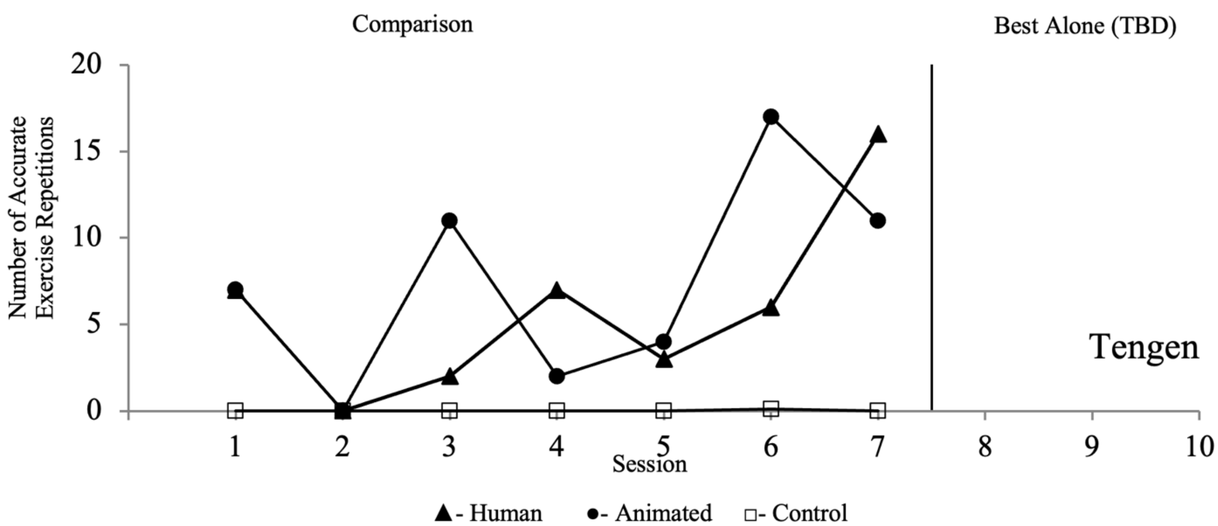


Figure 2 *Results for Tengen*

Maki’s data are displayed in Figure 3. Maki's human data exhibited a moderate to high level of responding, with moderate variability. Additionally, during the animated condition, Maki's responding varied from moderate to high levels with moderate variability. The control condition maintained a 0% stable level of responding, except for session six where responding was at a moderate level, at 50%. Researchers concluded that this spike in the control condition was because the exercise was titled, “punches”, a skill that this participant must have known before the study. Comparing the human to the control condition, using a point-by-point analysis, the human condition was higher than the control condition for 8/8 data points. Comparing the animated condition to the control condition, the animated condition was higher for 8/8 data points. Using a point-by-point analysis in which all three sessions were compared, two sessions showed higher responding in the human condition, three sessions displayed higher responding in the animated condition, and there was no difference in the remaining sessions. Therefore, there was no superior condition for Maki. This demonstrated that the human condition and the animated condition were both effective interventions. As both independent variables proved effective, researchers allowed Maki to choose which condition she preferred for her best alone condition. Researchers provided pictures of both models and asked her to choose which one she preferred to watch.

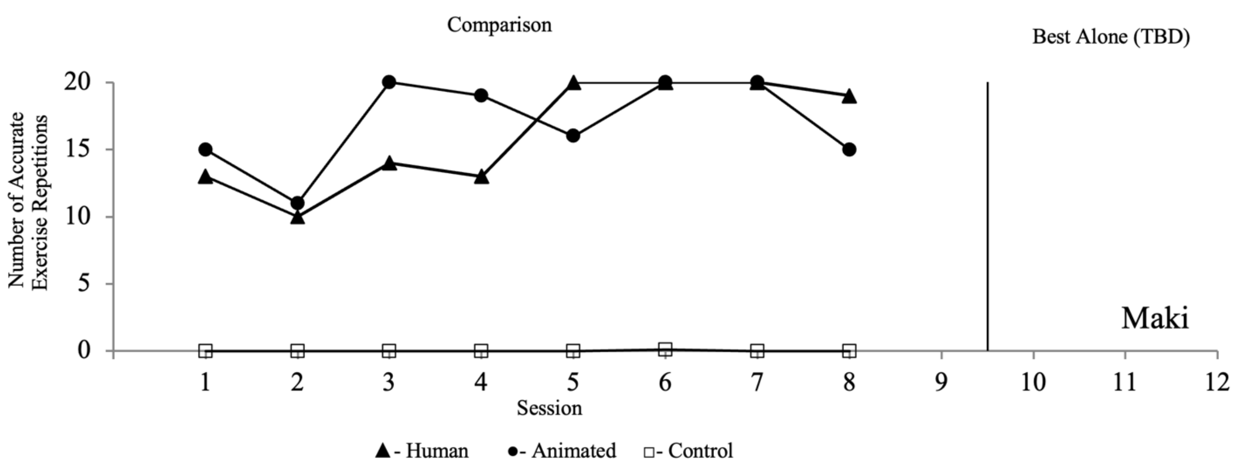


Figure 3 *Results for Maki*

Power’s data are displayed in Figure 4. Power's human data exhibited a low level of responding, with low variability. Further, during the animated condition, Power's responding varied from low to moderate levels with moderate variability. The control condition maintained a 0% stable level of responding for the entire duration of the study. Comparing the human to the control condition, using a point-by-point analysis, the human condition was higher than the control condition for three data points. Comparing the animated condition to the control condition, the animated condition was higher for 5 data points. Using a point-by-point analysis in which all three sessions were compared, the animated condition was the superior condition.

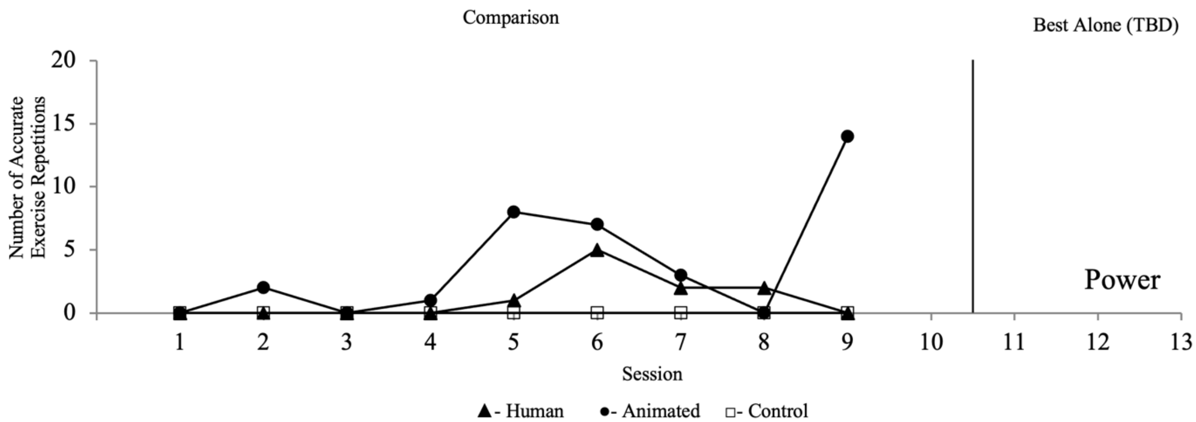


Figure 4 *Results for Power*

Discussion

The present study investigated the effects of animated versus human video models on the count of correctly performed exercise movements among high school students with intellectual disabilities. Our findings, utilizing an alternating treatment design with a best alone condition, revealed variability in participant responsiveness to different modeling methods. Specifically, a human model proved more effective for one participant, while an animated model demonstrated efficacy for another participant.

Interestingly, for two participants, no clear differentiation emerged regarding the effectiveness of the two models.

Importantly, our study contributes to existing literature by demonstrating that the animated condition was at least moderately effective for each participant, consistent with previous findings (Kellems et al., 2020; Kellems et al., 2022, Yalçın et al., 2023). This underscores the potential of animated models as effective instructional tools for individuals with intellectual disabilities, expanding the repertoire of successful outcomes through animation-based video modeling.

The effectiveness of both independent variables highlights the necessity of personalized approaches in intervention design for individuals with disabilities. Practitioners should consider tailoring interventions based on learner preferences and responsiveness, as this can significantly impact engagement and ultimately lead to optimal learning outcomes.

Limitations

Limitations in this study arose from the challenge of scoring exercise behaviors due to the highly specific nature of the task analysis. Participants occasionally fulfilled nearly all aspects of the task analysis but missed minor components, resulting in their overall performance being marked as incorrect for the entire exercise. For instance, in the case of Kite performing the running man exercise, he executed most of the task analysis, including moving his arms to each side, jumping, and placing one foot back, but failed to switch and put the opposite foot back. Despite completing most of the task analysis, missing a small step led to that repetition not being counted as correct. Consequently, many participants exhibited low response rates. This limitation hinders the study's ability to provide a true representation of the exercises completed, potentially impacting the count of responses observed.

Moreover, three out of four participants encountered motivation issues, which likely affected their performance consistency. This variability resulted in inconsistent response rates across participants, thereby generating data that are less valid and informative. Therefore, future research should consider integrating natural reinforcers, such as participant preferences, to mitigate these motivational challenges.

Future Research

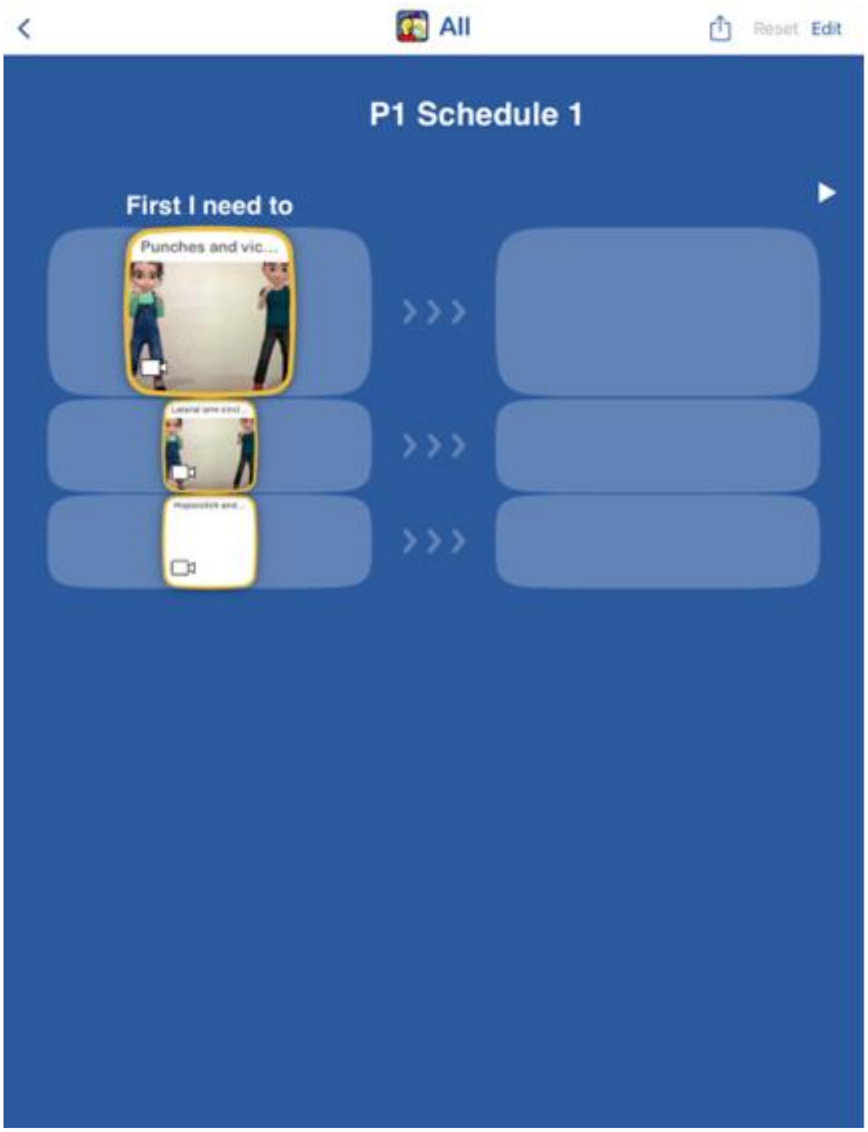
For future research, I recommend refining the task analysis process to ensure that minor components are accurately captured and scored. Engaging stakeholders such as primary teachers, caregivers, and individuals with intellectual disabilities themselves will be essential to develop a comprehensive, culturally sensitive, and meaningful task analysis protocol.

I also propose conducting preliminary trials using a video model not included in the study to assess the appropriateness of the task analysis and its ability to capture the targeted skills effectively. Furthermore, integrating learner preferences into the video model, such as allowing customization of the animated character or incorporating preferred music, could enhance engagement and effectiveness.

Additionally, I suggest exploring the effectiveness of animated models with different age groups. As the use of animated videos may vary across age groups, it would be valuable to determine which type of model is most effective for each age group. This analysis could provide insights into tailoring interventions to better meet the needs of individuals with intellectual disabilities across various developmental stages.

Appendices

Appendix A. Example of Choicework Interface at Start of Comparison Session



Appendix B. Data Sheet Displaying Procedural Fidelity

Correct workout schedule on app	
Task order randomized to match data sheet	
Exercise materials arranged correctly	
Ensures participant is ready and standing	
Provide task direction- "Follow your workout schedule on the iPad"	

Task order:	**Schedule 1**		
	Steps	Prompt	Praise
Select the first picture in the environment to play first VM			
LA1 H	1.Punches- take one hand and punch across body, bring back, take other hand punch across body		
	2.Squat- Squat, bring one arm above head, twist body opposite side, stand up, squat, bring other arm above head, twist body opposite side		
If columns are blank, give a (+); if there are checks, give a (-)			
Drag picture to *'all done'* column and select next picture, if available			
Allow participant to watch video until the video finishes			
Do not provide prompt to next video unless participant has not done it w/in 10s			
K1 C	Side bends- hands on hips, raise one arm up, bend body opposite direction, hands on hips, raise other arm up, bend body opposite direction		
	Windmill- arms extended horizontally, take one hand and touch opposite foot, stand up, take other hand and touch opposite foot		
If columns are blank, give a (+); if there are checks, give a (-)			
Drag picture to 'all done' column and select next picture, if available			
Allow participant to watch video until the video finishes			
Do not provide prompt to next video unless participant has not done it w/in 10s			
C2 A	Hand claps- Stand with hands at side, step to the side, bringing legs together and clapping overhead, step to the other side, bring legs together and clap overhead		
	Forward jumps- Swing arms down and behind your back, jump forward with both feet, stand straight up, rotate a half turn, jump forward with both feet		

If columns are blank, give a (+); if there are checks, give a (-)			
Allow student approximately 2 min to complete exercise if doing any moves in the exercise correctly or provide prompt to next video unless participant indicates they do not know what to do, or if 1 min of no response or errors			

Provide general praise at the end of the session (e.g., "Thanks for working out—you're getting stronger").	

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