ORIGINAL PAPER

Identifying and Validating Indices of Happiness and Unhappiness in Autistic Children and Examining Them as Quality of Life Indicators During Presession Pairing

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Abstract

Objectives Happiness is paramount to an improved quality of life (QoL), but there are barriers to assessing the happiness and overall QoL of autistic children using traditional measures. To address this, Study 1 aimed to identify and validate the idiosyncratic mood indices of three autistic children. In Study 2, these indices were measured as QoL indicators during discrete trial teaching (DTT) sessions that followed presession pairing. Task engagement was recorded as a secondary measure.
Methods Three preschool boys on the autism spectrum participated in both studies. Their individualized indices of happiness and unhappiness were first identified and validated using an abbreviated procedure that extended previous research. The effects of presession pairing were then examined using a concurrent multiple baseline design across participants. The idiosyncratic mood indices were measured using 10-s partial interval recording, while task engagement was measured using 15-s whole interval recording.
Results Study 1 demonstrated that the abbreviated procedure was efficient for identifying and validating the idiosyncratic mood indices of the participants. Study 2 found that presession pairing improved the mood of all three children during DTT, but there were minimal increases in task engagement. Percentage of nonoverlapping data (PND) scores initially revealed no effects for indices of happiness ($M = 43.2\%$), large effects for indices of unhappiness ($M = 76.4\%$), and no effects for task engagement ($M = 37.6\%$). Contrary to this, omnibus Tau-U scores suggested large effects for indices of happiness (Tau-U = 0.7), very large effects for indices of unhappiness (Tau-U = 0.9), and moderate effects for task engagement (Tau-U = 0.5).
Conclusions Individualized indices of happiness and unhappiness can and should be used as QoL indicators during behavioral interventions for autistic children.

Keywords Quality of life · Indices of happiness · Indices of unhappiness · Presession pairing · Discrete trial teaching

Approximately one in 100 children are diagnosed with autism spectrum disorder (ASD) worldwide (Zeidan et al., 2022). ASD is a neurodevelopmental condition that presents differently for each individual, and as a result, there are variations in the level of support needed. This makes it difficult to provide standardized services to all individuals within this community (Dawson-Squibb & de Vries, 2019). Studies have found that autistic individuals can experience a lower quality of life (QoL) than non-autistic individuals across the lifespan (Barneveld et al., 2014; Biggs & Carter, 2016; Egilson et al., 2017; Kamp-Becker et al., 2011; Kamp-Becker et al., 2010; Mason et al., 2018; van Heijst & Geurts, 2015). Chiang and Wineman (2014) found that certain factors such as age, difficulties with social skills and adaptive behaviors, higher support needs, and additional psychiatric conditions were strong predictors for a lower QoL in the autistic population. Therefore, an improved QoL is an outcome prioritized by the autism community and their families, and it should be considered the gold standard for assessing the social validity of behavior analytic interventions (Oakley et al., 2021; Schwartz & Kelly, 2021). Despite this, QoL seems to be overlooked within autism research (Burgess & Gutstein, 2007).

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QoL is a subjective concept, which is why there have been several attempts to define it over the years (Felce & Perry, 1995). According to the World Health Organization (WHO, 2012), QoL is defined as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (p. 3). Another definition that is considered more acceptable within disability research is the one proposed by Schalock and Alonso (2002). According to Schalock and Alonso (2002), QoL comprises eight domains, including emotional well-being, physical well-being, material well-being, social inclusion, interpersonal relationships, self-determination, rights, and personal development. However, emotional well-being, or one's personal satisfaction or happiness, is arguably the most important aspect of QoL (Carr, 2007; Parsons et al., 2012; Ramey et al., 2023).

Historically, the QoL of autistic people has been judged using the same quantifiable markers for both neurotypical and neurodivergent individuals (Oakley et al., 2021). This was problematic, as neurotypical ideologies (e.g., number of friendships) were being applied to autistic individuals, while their subjective QoL (e.g., satisfaction with friendships) was often neglected (Oakley et al., 2021). From an ethical viewpoint, this is a human rights violation, as generic standards of QoL do not allow fair, respectful, equal, and dignified support (Health Information and Quality Authority, 2019). Furthermore, the most widely used QoL assessments are self-reported Likert-type rating scales or questionnaires, which can lack validity for autistic individuals (Verdugo et al., 2005). Waters et al. (2009) also found that many QoL assessments focus on functional skills rather than overall well-being. While proxy reports have been used, both Hong et al. (2016) and Ikeda et al. (2014) found disparities between self-reported QoL and maternal proxy reports.

In their systematic review of QoL measures for autistic adults, Ayres et al. (2018) found that seven general QoL assessments were used across the 14 included studies, but none of these tools had been validated with autistic adults. Only one study used an autism-specific QoL measure (i.e., Billstedt et al., 2011), but the authors stated more testing was needed before it could be considered valid for this population. Following this, McConachie et al. (2018) developed nine autism-specific items (ASQoL) for use alongside the WHOQOL-BREF (The WHOQOL Group, 1998) and WHO Disabilities module (Power et al., 2010). These items were found to be valid and reliable for measuring the QoL of autistic adults. Meanwhile, only the Pediatric Quality of Life Inventory™ (PedsQL; Varni & Limbers, 2009) has been found to have high reliability and validity for autistic children and youth (Ikeda et al., 2014). However, the use of this assessment has been limited to adolescents and children with lower support needs. This indicates that there is a pressing need for a valid and reliable measure of QoL for young autistic children who have limited language and higher support needs (i.e., needing full-time care).

As personal satisfaction or happiness is regarded as the central tenet of QoL, behavioral indicators of happiness have been used as measures of emotional well-being and overall QoL (Dillon & Carr, 2007; Lancioni et al., 2005; Lattimore et al., 2009; Parsons et al., 2012; Ramey et al., 2023). Green and Reid (1996) first attempted to operationally define these indices as "any facial expression or vocalization typically considered to be an indicator of happiness [or unhappiness] among people without disabilities" (p. 69). This included smiling, laughing, yelling while smiling, frowning, grimacing, crying, and yelling without smiling. However, as pointed out by Parsons et al. (2012) and Ramey et al. (2023), indices of happiness and unhappiness can be more idiosyncratic for individuals with disabilities, especially individuals on the autism spectrum.

Parsons et al. (2012) recommended the use of individualized indices of happiness and unhappiness to accurately measure the mood and overall QoL of autistic adults. To identify these mood indicators, they asked staff members to list the overt behaviors that were likely to occur in situations where the participants were considered happy or unhappy. Behaviors reported by at least two staff members were used to operationally define the indices of happiness and unhappiness for each participant. They were then able to validate these definitions, as the identified indices of happiness increased during each participant's happy situation and decreased during their unhappy situation. They further validated these mood indicators through a choice evaluation, where the participants were asked to choose between their happy and unhappy situations. All participants selected their happy situation. Choice validation is an essential component of research because it can confirm observed responses while supporting self-determination (Felce & Perry, 1995). These procedures were partially replicated by Ramey et al. (2023), who found that indices of happiness and unhappiness could be operationally defined and reliably measured among young autistic children.

Idiosyncratic indices of happiness and unhappiness have been relatively accepted as valid and reliable assessments of QoL (Dillon & Carr, 2007; Parsons et al., 2012; Ramey et al., 2023). However, there has been a paucity of studies that have focused on enhancing and measuring overt indicators of happiness or unhappiness among individuals within the autism community (Ramey et al., 2019). Even though it has been established that autistic people experience a lower QoL than others, studies have primarily focused on interventions to improve the QoL of their caretakers rather than the autistic individuals themselves (Khanna et al., 2011; Rayan & Ahmad, 2016). Rather, there has been an overwhelming amount of research on improving the communication,

language, socialization, motor skills, cognitive abilities, adaptive, and daily living skills of young autistic children (see Daniolou et al., 2022; Makrygianni et al., 2018; Peters-Scheffer et al., 2011; Virués-Ortega, 2010, for reviews of this literature). While it can be argued that these skills are needed for an improved QoL, this was not a direct outcome measure within the included studies. Individualized care systems can – and should be – devised by measures of happiness during interventions aimed at improving the QoL of individuals with disabilities (Green & Reid, 1996; Parsons et al., 2012).

One approach that could improve the happiness of children with disabilities during instruction is presession pairing. Presession pairing is a rapport-building procedure whereby the instructor presents a preferred item or activity to the child and interacts with the child without placing any instructional demands before teaching takes place (Gormley et al., 2020; Kelly et al., 2015; Sundberg & Partington, 2010). To improve these rapport-building sessions, the instructor should demonstrate a number of skills, including proximity, praise, reflection, imitation, description, initiation, and creativity (Lugo et al., 2017). By engaging in these behaviors, the teacher associates themselves and the learning environment with positive reinforcement (Gormley et al., 2020). In turn, this can decrease the aversiveness of an academic task, which can otherwise act as a reflexive conditioned motivating operation (CMO-R) that evokes escape-maintained problem behaviors (McGill, 1999). More importantly, the rapport between staff members and service recipients has been found to increase indicators of happiness among individuals with disabilities (Parsons et al., 2016).

Several studies have demonstrated the efficacy of presession pairing and rapport building for increasing the academic responding and pre-attending skills of young autistic children during discrete trial teaching (DTT), while simultaneously reducing their problem behaviors (Cariveau et al., 2020; Kelly et al., 2015; McLaughlin & Carr, 2005; Shillingsburg et al., 2014; Shillingsburg et al., 2019). Other studies have shown that presession pairing skills can be systematically taught to different service providers using a training protocol, which demonstrates the fidelity of such procedures (Gormley et al., 2020; Lugo et al., 2017; Lugo et al., 2019; Shillingsburg et al., 2019). The social validity of presession pairing was also demonstrated by Lugo et al. (2019) when they examined their participant's preference for various therapeutic conditions, namely presession pairing before DTT, free play before DTT, and DTT alone. They found that the participant preferred presession pairing before DTT across multiple therapists.

While the aforementioned studies advocated for presession pairing prior to DTT to improve task engagement and reduce behaviors that challenge, none of the studies explored the effects of presession pairing on the children's happiness during instruction. Simply put, it could be argued that the most meaningful outcome of this intervention (i.e., an improved QoL) has not yet been examined in the literature. Therefore, the aim of this research was to address this limitation and other gaps within the literature by implementing two separate studies. In order to objectively evaluate the social validity of presession pairing using mood as a QoL indicator, the learner's idiosyncratic indices of happiness and unhappiness must first be identified. Thus, the purpose of Study 1 was to systematically identify and validate the individualized indices of happiness and unhappiness of each participant using an abbreviated version of the procedures implemented by Parsons et al. (2012) and Ramey et al. (2023). This study extended previous research by implementing an abbreviated validation process that involved a single happy and unhappy session for each participant. The purpose of Study 2 was then to examine the effects of presession pairing on the children's individualized indices of happiness and unhappiness during DTT sessions. By observing behavioral indicators of mood, this study employed a more objective approach to assessing the social validity of presession pairing as an intervention for autistic children. In addition to the idiosyncratic mood indices, task engagement was also measured during the teaching sessions.

Study 1

Method

Participants

Three children were recruited from a private Montessori school in the Republic of Ireland. Their ages ranged from 4 years, 2 months to 5 years, 6 months ($M = 5$ years old). All participants had a formal diagnosis of ASD from an independent psychologist. None of the participants had a secondary diagnosis at the time of the study. Pseudonyms were given to the participants to maintain anonymity and confidentiality.

Antonio was 5 years, 6 months old and was in Phase IV of the Picture Exchange Communication System (PECS). He could communicate vocally using one-word requests but more frequently used his PECS. Jacque Paul was 4 years, 2 months old and was in Phase IIIA of his PECS. Like Antonio, Jacque Paul could communicate with one-word requests, but more frequently used his PECS. Wayne was 5 years, 4 months old and was also in Phase IV of his PECS. In addition to his PECS, Wayne could communicate using short phrases like "I want ___" or "I don't like ___."

The participants were specifically recruited for the study as they were identified by the school's Board Certified Behavior Analyst (BCBA) as students who would potentially benefit from the intervention. Furthermore, the parents

of these participants had provided informed consent for their children to participate. Assent was obtained from the children themselves through a specially constructed Social Story.

Procedure

This study implemented a four-step identification and validation process that involved the following: (1) familiar adults completed the Indices of Happiness and Unhappiness Questionnaire; (2) informal observations were conducted to operationally define the indices; (3) idiosyncratic happy and unhappy sessions were implemented with each participant to initially validate their identified indices; and (4) a choice comparison was conducted to further validate those indices.

Setting

The identification and validation procedure took place in the children's typical classrooms. Antonio and Wayne were in the same classroom, while Jacque Paul was in another classroom. Both classrooms had desks, chairs, toys, and visual supports relevant to an autism playschool. In Antonio and Wayne's classroom, there was also a slide, climbing frame, hammock chair, kitchen set, and seesaw.

Materials

The materials were individualized, as they were based on the idiosyncratic happy and unhappy sessions implemented for each participant. For instance, a hammock chair was used for Antonio, an iPad was used to play cartoons for Wayne, and balloons and bubbles were used with Jacque Paul. An iPad was used to video record the happy and unhappy sessions, while a partial interval recording data sheet was used to mark the presence of the indices of happiness and unhappiness.

Identification Process

Indices of Happiness and Unhappiness Questionnaire The Indices of Happiness and Unhappiness Questionnaire (Ramey et al., 2023) was used to identify the idiosyncratic mood indicators of each participant. Four adults who were most familiar with each participant (i.e., three staff members and one parent) completed the Indices of Happiness and Unhappiness Questionnaire. The staff members included a special needs assistant (SNA), an applied behavior analysis (ABA) tutor, and a BCBA. The SNA and ABA tutor held bachelor's degrees, while the ABA tutor was completing a master's degree in ABA at the time of the study. The BCBA

held a graduate-level certification in ABA and was responsible for supervising and training other staff members.

In the first two questions of the questionnaire, respondents were asked to list specific behaviors that were recognized as happy or unhappy indicators for the child. In the latter two questions, they were asked to describe situations in which the child was most likely to be happy and unhappy, respectively. The responses from each adult were compared to identify common idiosyncratic happy and unhappy behaviors. Any indicator that was agreed upon by at least two adults was selected for observation. The indices of happiness and unhappiness that were unanimously agreed upon by all respondents for each participant are identified in Table 2. For Antonio, all respondents agreed upon six indices of happiness and five indices of unhappiness. For Jacque Paul, all three indices of happiness and two indices of unhappiness were identified by all respondents. Two indices of happiness and three indices of unhappiness were identified by all of Wayne's respondents.

Informal Observations To confirm the presence of the mood indices, each participant was informally observed for one school day. During these observations, the participants engaged in their regularly scheduled school routines that included both preferred and non-preferred activities. Based on these observations and conversations with the questionnaire respondents, operational definitions were developed for each participant's indices of happiness and indices of unhappiness.

Validation Process

Happy and Unhappy Sessions To initially validate the indices of happiness and unhappiness identified for each participant, the indices were observed during idiosyncratic happy and unhappy sessions that were identified by the last two questions of the Indices of Happiness and Unhappiness Questionnaire. Any happy or unhappy situation that was agreed upon by two or more adults was selected for this phase of the study. If more than one activity or situation was identified for either the happy or unhappy session, the researcher selected the one that required fewer resources (e.g., less members of staff, less distraction for other students). For example, for Antonio's happy situation, the hammock chair in the garden was selected over sensory or messy play in the classroom. The happy and unhappy situations selected for each participant can be seen in Table 1.

This phase of the study was abbreviated, as compared to the procedures outlined by Parsons et al. (2012) and Ramey et al. (2023), in that a single happy session and a single unhappy session were conducted with each participant to validate their mood indices. The sessions lasted 10 min each,

Table 1 Happy and unhappy situations identified for each participant

Participant	Happy situation	Unhappy situation
Antonio	Playing in the hammock chair	Academic work
Jacque Paul	Playing with preferred or new toys	No access to preferred toys or activities
Wayne	Playing with preferred toys or engaging in preferred activities	Interruption of an activity he enjoys

and they were embedded into the children's typical school routine. Both sessions were conducted in the morning after circle time (i.e., at the beginning of the school day). Two tutors who were most familiar with the participants conducted the sessions. To protect the participants and staff and to minimize the distress of the participants during their unhappy session, it was to be terminated based on individualized criteria. The termination criterion for Antonio was any instance of him biting. Jacque Paul's unhappy session was to be terminated if he engaged in grabbing two or more times, while Wayne's session was to be terminated if he hit his peers. None of the unhappy sessions had to be terminated.

Choice Comparison Due to the age of the participants and their limited expressive language, they could not verbally report their feelings of happiness or unhappiness during the happy and unhappy situations to further validate the observed mood indices. Therefore, as a secondary validation measure, a choice comparison was conducted as outlined by Parsons et al. (2012). During the choice comparison, the participants were presented with a choice board with a picture of their happy situation and a picture of their unhappy situation, and they were asked to choose one. Upon making a choice, the participants were given access to their selected activity for 5 min. The researcher conducted the choice comparison with Antonio, while a tutor conducted Jacque Paul's and Wayne's choice comparisons.

Measures

Based on the informal observations and conversations with familiar adults, operational definitions were developed for each participant's indices of happiness and indices of unhappiness (Table 2). These individualized mood indicators were measured during the happy and unhappy sessions using 10-s partial interval recording.

Data Analyses

The percentage of intervals with indices of happiness and the percentage of intervals with indices of unhappiness were reported for each participant's happy and unhappy session.

Results

All participants showed more indices of happiness during their happy situation when compared to their unhappy situation (Fig. 1). Similarly, all participants showed more indices of unhappiness during their unhappy situation when compared to their happy situation (Fig. 2). These observations provided initial evidence of validity for the adult-nominated mood indicators for each participant.

To further validate the identified indices of happiness and unhappiness for each participant, the choice comparison was conducted. All participants chose their happy situations, which provided further evidence that the observed indices of happiness and unhappiness were valid, as the participants selected the activity that increased their indices of happiness and decreased their indices of unhappiness.

Study 2

Method

Participants

Antonio, Jacque Paul, and Wayne also participated in Study 2. There were no changes in their communication skills or educational needs between the two studies.

Procedure

All sessions were conducted by the researcher and a tutor. More specifically, the sessions for Antonio were conducted by the researcher and video recorded by a tutor, or by the researcher if the school was understaffed. On the other hand, a tutor conducted sessions with Jacque Paul and Wayne, and their behaviors were video recorded by the researcher. During each school day (except for Wednesdays), one session was implemented with each participant unless the participant was absent. If a participant was informally observed to be engaging in high frequencies of happy or unhappy indicators prior to the start of a session, the session was delayed

Table 2 Operational definitions of indices of happiness and unhappiness for each participant

Name	Indices of happiness	Indices of unhappiness
Antonio	Smiling: corners of the mouth turned up with or without showing teeth * Jumping: two or more instances of both feet off the floor vertically while standing or sitting * Laughing: giggling or producing a series of inarticulate and audible noises while smiling * Banging items on chest: rhythmic hitting of preferred items off chest Running: moving at speed faster than walking and not having both feet on the ground at the same time, either in the garden or in the classroom * Flapping hands: two or more consecutive instances of shaking one or both hands in up and down or side-to-side movement * Repetitive vocalizations: making any audible noise (including nonsensical sounds) unrelated to the present situation repeatedly Putting hand on face: firmly pressing an adult's hand on his mouth to kiss (touching lips to an adult's palms), licking (passing tongue over an adult's palm), or nibble (gentle contact between Antonio's upper and lower teeth and an adult's palm) *	Biting: any attempt of his teeth making forceful contact with an individual's body or clothing with or without his mouth closing, not inclusive of inanimate objects * Crying: occurrence of vocalizations accompanied by facial contractions with or without tears * Elopement: any instance of Antonio moving away from an adult without permission or relation to the present situation accompanied by crying or screeching Pinching: any instance of Antonio's fingers contacting an individual's skin using a pincer grip * Flopping: any instance of Antonio lying or kneeling on any surface as a result of his body going limp and out of context to the present situation (with or without crying) Pressure seeking: grabbing an adult's hand(s) in order to squeeze his palms * Throwing: any instance of Antonio throwing work materials or toys while screeching *
Jacque Paul	Smiling: corners of the mouth turned up with or without showing teeth and with or without the corners of the eyes crinkling * Singing: repeated vocalizations of nursery songs or repeating the statements of other individuals in a positive sing–song tone * Laughing: giggling, chuckling, or producing a series of audible noises while smiling with or without jumping up and down *	Crying: the occurrence of loud vocalizations accompanied by facial contractions with or without tears * Flopping: any instance of lying or kneeling on any surface as a result of his body going limp and out of context to the present situation, accompanied by screaming (with or without crying) Grabbing: any occurrence of Jacque Paul seizing or clutching an item or piece of an individual's clothing to get attention (with or without crying and flopping) * Elopement: any instance of Jacque Paul moving away from an adult without permission or relation to the present activity accompanied by crying
Wayne	Smiling: corners of the mouth turned up with or without showing teeth and with or without the corners of the eyes crinkling * Laughing: giggling and chuckling, with or without narrating or pointing at a funny situation Eye contact: movement of Wayne's head and eyes toward the communication partner and holding eye contact for up to 3 seconds Cooperation: Engaging in activities or tasks given to him accompanied by smiling, laughing, and commentary *	Hitting: forcefully contacting another person's body with open or closed fists accompanied by crying * Crying: the occurrence of vocalizations accompanied by facial contractions with tears and with or without Wayne saying "no, no, no" * Pushing: Wayne using any part of his body to forcefully contact another person's body, accompanied by crying Throwing: any instance in which Wayne moves work materials or furniture farther than a foot or away from the work or activity table accompanied by screaming or crying * Screaming: any occurrence of vocalizations louder than the conversational pitch for any period of time with or without pacing, running away, and/or crying

Indices with an asterisk (*) indicate those that were unanimously agreed upon by all respondents

Fig. 1 The percentage of intervals with indices of happiness during the idiosyncratic happy and unhappy sessions for each participant
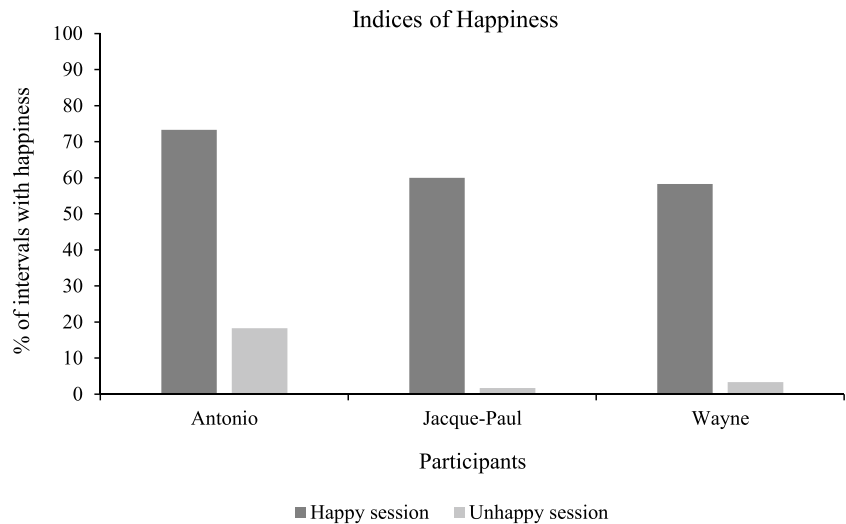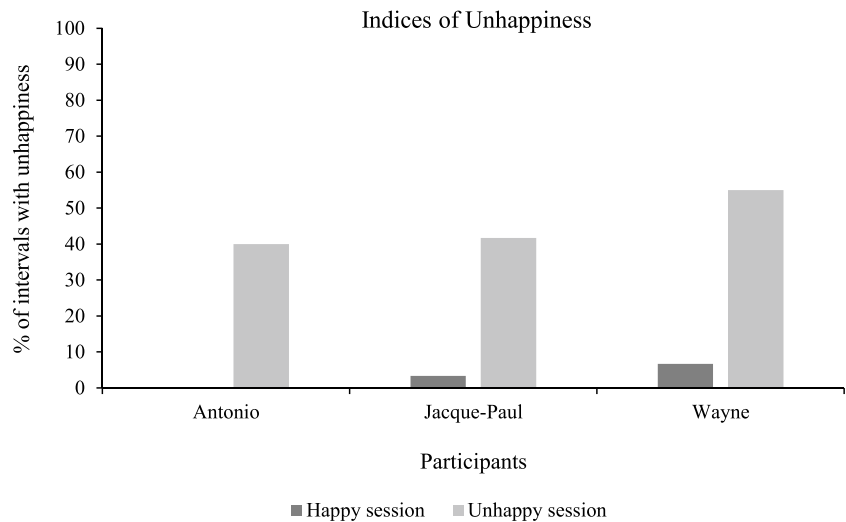

Fig. 2 The percentage of intervals with indices of unhappiness during the idiosyncratic happy and unhappy sessions for each participant

until the participant was displaying neutral behaviors. All baseline and intervention DTT sessions lasted 15 min.

Setting

All sessions took place in the children's typical classrooms. Most staff and students were present throughout the study to maintain consistency; however, there were several absences due to the ongoing COVID-19 pandemic. Staff members were instructed to redirect non-participants away from where the sessions were taking place. The DTT sessions were conducted in a familiar place (i.e., the children's work tables) to avoid distressing the participants and to reduce the likelihood of extraneous variables affecting the sessions.

Materials

The materials were unique to each participant because they depended on the children's preferred items and their DTT targets, which were determined through each participant's individualized education program (IEP). To obtain assent from the participants prior to each session, visual icons representing "Yes" and "No" were used. A "first/then" visual was also used, which consisted of a picture card depicting "work" and a picture of a preferred item placed on Velcro. Preference assessment data sheets were used to identify the participants' preferred items, while partial and whole interval recording data sheets were used to mark the presence of indices of happiness and unhappiness and task engagement, respectively. An iPad was used to video record all sessions.

Experimental Design

A concurrent multiple baseline across participants design was used, where the baseline was introduced to all participants at the same time. The intervention condition was introduced in a time-lagged fashion, and the length of the baseline varied across participants. For Antonio, the baseline consisted of 6 sessions, while the intervention lasted 12 sessions. For Jacque Paul, the baseline lasted for 8 sessions, while the intervention lasted 11 sessions. Lastly, Wayne's baseline consisted of 9 sessions, while intervention only lasted for 5 sessions. The number of intervention sessions conducted with Wayne was significantly reduced due to the school's closure as a result of the COVID-19 pandemic.

Preference Assessment

Prior to baseline, a multiple stimulus without replacement (MSWO) preference assessment was conducted with each participant. During this assessment, the participant was shown an array of five toys or objects that represented activities, and they were prompted to select an item. Upon selection, the participant was allowed to play with the toy or engage in the activity for 10 s. Their selected item was then removed from the array, the remaining items were rearranged, and the participant was prompted to choose from an array of four items. This selection process continued until all items had been selected or the participant would no longer select an item. The selection process was repeated three times, and an MSWO data sheet was used to record item position and the order of selection. To determine which items were preferred, the selection order during each of the three trials was summed and the items with the lowest sums were considered highly preferred. Antonio's most-preferred activity was playing with letters, while his second preferred activity was being pushed in the hammock chair while getting tickles from the researcher. Wayne's most-preferred activity was watching Batman from the cartoon DC Super Friends, while his second favorite was watching the cartoon Spidey and His Amazing Friends. Biscuits were Jacque Paul's most-preferred item, which were closely followed by an elephant toy and bubbles.

Baseline

In this condition, the participants did not receive any presession pairing before their DTT sessions. Participants were approached with the "first/then" visual before being directed to their worktables. The preferred item displayed on the visual was based on the results of the MSWO preference assessment. The participants were given academic tasks relevant to their IEP, and they earned access to their preferred item according to their individualized reinforcement schedules.

While Antonio and Jacque Paul engaged in one-on-one DTT sessions, Wayne had group DTT sessions with two peers that had similar scores on the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2014). As the study was conducted close to the end of the academic year, VB-MAPP testing was conducted during some of the baseline sessions across all participants.

Presession Pairing

During the intervention, a 10-min pairing session was conducted with each participant prior to their DTT session. During this rapport-building procedure, the researcher or tutor interacted with the participant while they engaged with the preferred toy or activity that was identified by the MSWO preference assessment. However, a few adjustments were made due to the item or activity identified for each participant. For example, when Antonio was offered letters (his most-preferred item) during the initial pairing sessions, he chose to play on the hammock chair, so the hammock chair was used for the remaining sessions. For Wayne, both preferred cartoons (i.e., DC Super Friends and Spidey and His Amazing Friends) were used interchangeably throughout the pairing sessions to avoid satiation. Finally, due to the ethical implications with delivering biscuits for 10 min, Jacque Paul's tutor blew bubbles and played with him while intermittently giving him biscuits during his pairing sessions. During pairing, no demands were placed. The researcher or tutor followed the lead of the participant's play while observing, commenting, or imitating their play when appropriate. Following the presession pairing, the DTT sessions were conducted as described for baseline.

Measures

The two primary dependent variables for this study were the participants' individualized indices of happiness and indices of unhappiness identified and validated in Study 1. In addition to these indices, task engagement was also measured during each session. Task engagement for all three participants was defined as "starting the academic task within 5 s of the instruction and remaining engaged in that activity regardless of the accuracy of the response." The children were considered to be engaged in the activity if they were not moving away from the table and they were demonstrating one or more of the following indices: (a) looking at the instructor or materials, (b) manipulating the materials in response to the discriminative stimulus (S^D), and/or (c) responding to the S^D vocally or through motor movements.

The researcher used video recordings to ensure accurate data collection. In line with previous research (i.e., Parsons et al., 2012; Ramey et al., 2023), indices of happiness and indices of unhappiness were measured using 10-s partial

interval recording. As task engagement was a continuous behavior with a longer duration, it was measured using 15-s whole interval recording. All baseline and intervention DTT sessions lasted 15 min, so there were ninety 10-s intervals and sixty 15-s intervals. The percentage of intervals with indices of happiness and indices of unhappiness were reported. Similarly, the percentage of intervals with task engagement was also reported.

Reliability

To ensure the reliability of the data collection procedures, interobserver agreement (IOA) was calculated for indices of happiness, indices of unhappiness, and task engagement. A second observer (i.e., another tutor at the school) independently watched the videos and collected data for at least 26% of the sessions for each participant across both baseline and intervention conditions. This was in accordance with the recommendations made by Wolery et al. (2011).

IOA was calculated on an interval-by-interval basis. An agreement was marked when both the researcher and the second observer recorded the occurrence or non-occurrence of the behavior in the interval. IOA was calculated by dividing the number of agreements by the total number of intervals and multiplying by 100. The mean IOA for indices of happiness was 96% (range = 91–100%), while the mean IOA for indices of unhappiness was 93.7% (range = 89–100%). The mean IOA for task engagement was 85.9% (range = 82.6–90%).

Data Analyses

The mean percentage of intervals with indices of happiness, indices of unhappiness, and task engagement during baseline and intervention were calculated for each participant. The data were also analyzed for variability, level, and trend within both phases. The percentage of nonoverlapping data (PND) was calculated to discern the effectiveness of the intervention (Scruggs & Mastropieri, 1998). This is a recommended non-parametric test for single-subject research designs (Maggin et al., 2011). However, PND can present with some limitations, such as vulnerability to outliers (Rakap, 2015), lower scores when there is variability in baseline (Scruggs & Mastropieri, 2013), and it cannot address trends or be used for significance testing (Vannest & Ninci, 2015). Therefore, Tau-U was also calculated. Tau-U is another nonparametric statistical method that can be used with multiple baseline designs (Rakap, 2015; Lee & Cherney, 2018). A Tau-U score of 0.0 to 0.2 indicated a "small effect"; a score of 0.2 to 0.6 indicated a "moderate effect"; a score of 0.6 to 0.8 indicated a "large effect," while a score of 0.8 to 1.0 indicated a "very large effect" (Vannest & Ninci, 2015).

Results

Indices of Happiness

For all three participants, indices of happiness increased during the presession pairing intervention as compared to baseline (Fig. 3). Antonio demonstrated more indices of happiness during the intervention ($M = 58.8\%$, range: 35.6–82.2%) than during baseline ($M = 40.2\%$, range: 21.1–62.2%). There was a stable but rapidly decreasing trend in Antonio's indices of happiness during baseline. During the intervention, his indices of happiness showed variability, but they increased to a moderate-to-high level. The PND score for Antonio's indices of happiness was 33.3%, while the Tau-U score was 0.8, suggesting a very large effect.

Jacque Paul also engaged in more indices of happiness during the intervention ($M = 52.7\%$, range: 34.4–67.8%) than during baseline ($M = 30.1\%$, range: 10–55.6%). His indices of happiness were variable at a low-to-moderate level during baseline. During the intervention phase, Jacque Paul's indices of happiness were variable but increased to a more moderate level. The PND score for Jacque Paul's indices of happiness was 36.4%, while the Tau-U score was 0.7, indicating a large effect.

Wayne also showed more indices of happiness during the intervention ($M = 53.1\%$, range: 28.9–71.1%) than during baseline ($M = 36.1\%$, range: 26.7–47.8%). During baseline, Wayne's indices of happiness were variable at a low-to-moderate level. During the intervention, there was more stability and a gradual increase to a moderate-to-high level. The PND score for Wayne's indices of happiness was 60%, while the Tau-U score was 0.6, demonstrating a large effect.

The omnibus effect size for indices of happiness was Tau-U = 0.7, suggesting that presession pairing had a large effect on the participants' indices of happiness.

Indices of Unhappiness

The indices of unhappiness decreased during intervention for all participants (Fig. 3). Antonio engaged in less indices of unhappiness during intervention ($M = 3.8\%$, range: 0–12.2%) than during baseline ($M = 9.3\%$, range: 4.4–14.4%). During baseline, there was a gradual increase in Antonio's indices of unhappiness but they remained at a low level. During the intervention, his indices of unhappiness were variable at a low level during the first six sessions, then reduced to a near-zero level for the remainder of the sessions. The PND score for Antonio's indices of unhappiness was 58.3%, while the Tau-U score was 0.8, indicating a very large effect.
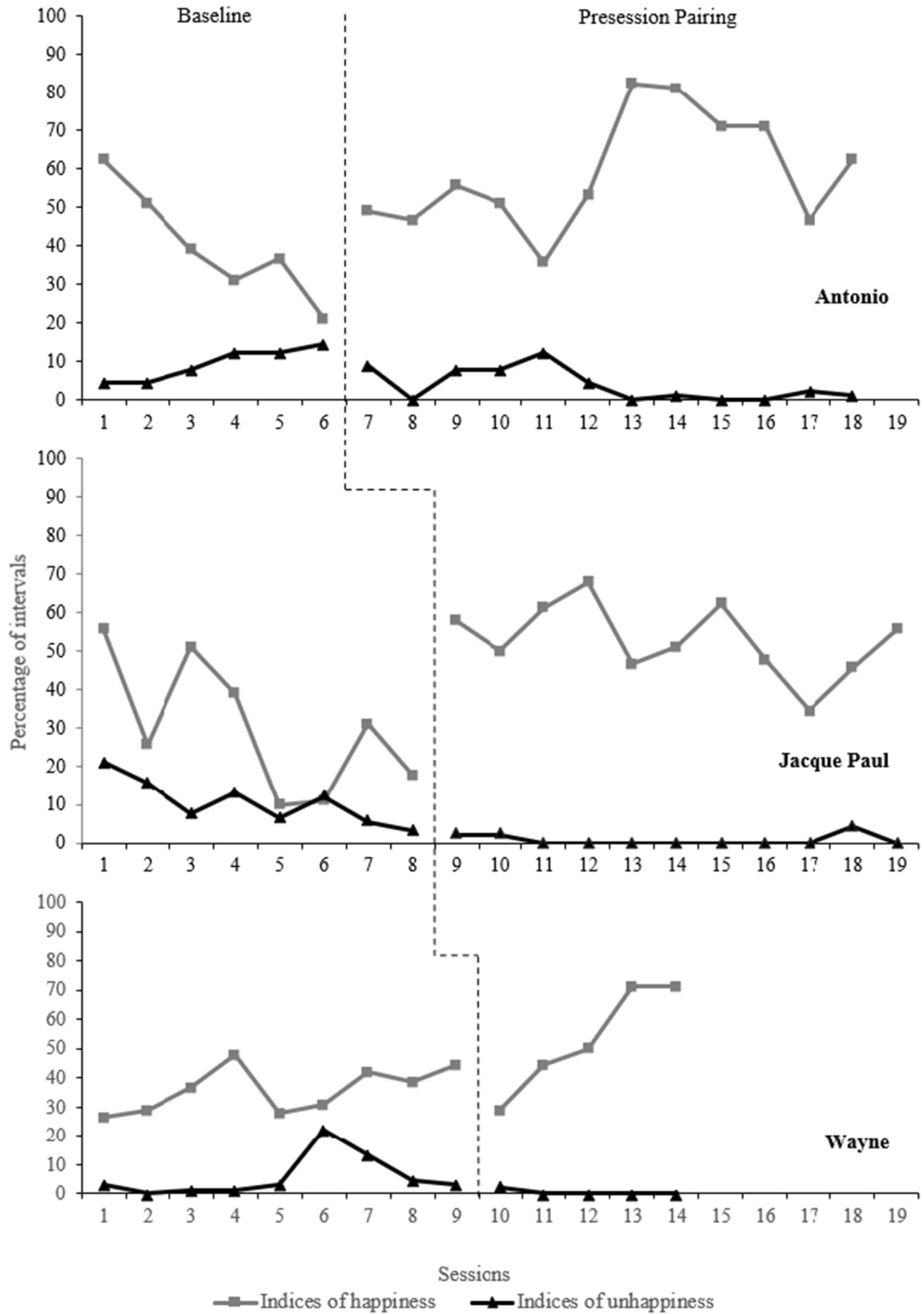
Indices of happiness ▪ *Indices of unhappiness* ▲

◀**Fig. 3** The percentage of intervals with indices happiness and indices of unhappiness during baseline and presession pairing

Jacque Paul also showed less indices of unhappiness during intervention ($M = 0.8\%$, range: 0–4.4%) than during baseline ($M = 10.7\%$, range: 3.3-21.2%). Jacque Paul's indices of unhappiness were variable at a low level during baseline. However, during the intervention phase, his indices of unhappiness occurred at a low level during three sessions, then remained stable at zero for the remaining sessions. The PND score for Jacque Paul's indices of unhappiness was 90.9%, while the Tau-U score was 0.9, indicating a very large effect.

Wayne also engaged in less indices of unhappiness during intervention ($M = 0.4\%$, range: 0–2.2%) than during baseline ($M = 5.8\%$, range: 0–22.2%). Wayne's indices of unhappiness were variable at a low level during baseline, but they only occurred once at a low level during the intervention. The PND score for Wayne's indices of unhappiness was 80%, while the Tau-U score was 0.8, suggesting a very large effect.

The omnibus effect size for indices of unhappiness was Tau-U = 0.9, suggesting that presession pairing had a very large effect on the participants' indices of unhappiness.

Task Engagement

Figure 4 shows that task engagement was slightly higher for all participants during the presession pairing intervention as compared to the baseline. For Antonio, the mean percentage of intervals with task engagement was higher during the intervention ($M = 62.6\%$, range: 41.7–71.7%) than during baseline ($M = 53.1\%$, range: 31.7–63.3%). During baseline, Antonio's task engagement was variable at a mostly moderate level. However, during the intervention, his task engagement was more stable at a moderate-to-high level. The PND score for Antonio's task engagement was 58.3%, while the Tau-U score was 0.5, suggesting a moderate effect.

Jacque Paul also showed higher task engagement during the intervention ($M = 39.1\%$, range: 21.7–48.3%) than during baseline ($M = 27.9\%$, range: 16.7–40%). Jacque Paul's percentage of intervals with task engagement was variable at a mostly low level during baseline. During the intervention, his task engagement remained variable at a low-to-moderate level. The PND score for Jacque Paul's task engagement was 54.5%, while the Tau-U score was 0.7, suggesting a large effect.

Finally, Wayne also demonstrated more task engagement during the intervention ($M = 55\%$, range: 40–63.3%) than during baseline ($M = 48.3\%$, range: 20–85%). Wayne's percentage of intervals with task engagement was variable at a mostly moderate-to-high level during baseline. During the intervention, his task engagement showed more stability and

the percentage of intervals occurred at a moderate level. The PND score for Wayne's task engagement was 0%, while the Tau-U score was 0.4, suggesting a moderate effect.

The omnibus effect size for task engagement was Tau-U = 0.5, suggesting that presession pairing had a moderate effect on the participants' task engagement.

Discussion

An improved QoL should be the primary outcome of behavior analytic services (Schwartz & Kelly, 2021), but there is a need for a valid QoL measure for the autistic population (Ramey et al., 2023). As happiness is essential for an improved QoL, it has been suggested that individualized mood indices can be measured to objectively assess the QoL of individuals with limited communication (Dillon & Carr, 2007; Parsons et al., 2012; Ramey et al., 2023). This study extended previous research by further developing a systematic method for identifying and validating the idiosyncratic mood indicators of three autistic children. In contrast to previous studies (i.e., Parsons et al., 2012; Ramey et al., 2023), this study provided a framework for a more time-efficient validation process. This abbreviated procedure could be considered more socially valid for the classroom setting.

Another objective of this study was to measure the children's individualized mood indices as the primary outcome of the intervention, as suggested by previous research (i.e., Ramey et al., 2019). Therefore, the aim of Study 2 was to determine whether presession pairing would improve the indices of happiness and unhappiness of the children during DTT sessions. The study found that for all three participants, indices of happiness increased and indices of unhappiness decreased during the DTT sessions that were preceded by presession pairing. PND scores revealed that presession pairing had a larger effect on indices of unhappiness than indices of happiness. According to Scruggs and Mastropieri (1998), a PND score below 50% suggests that the intervention was ineffective. While PND scores revealed no effect on indices of happiness, the omnibus Tau-U score was 0.7, which suggested a large effect.

Although PND is a widely accepted statistical measure (Rakap, 2015), it is sensitive to variability in baseline data which can result in lower scores (Scruggs & Mastropieri, 2013). PND relies on a single baseline data point while disregarding other baseline data and trends (Rakap, 2015). This could explain the low PND scores for indices of happiness when compared to the related Tau-U scores. Rakap (2015) found Tau-U to have better discriminability and sensitivity than other nonparametric measures. Unlike PND, Tau-U scores are robust to outliers, as they measure intervention phase trends and correct for baseline trends (Lee & Cherney, 2018). Notwithstanding its strengths, the Tau-U measure has
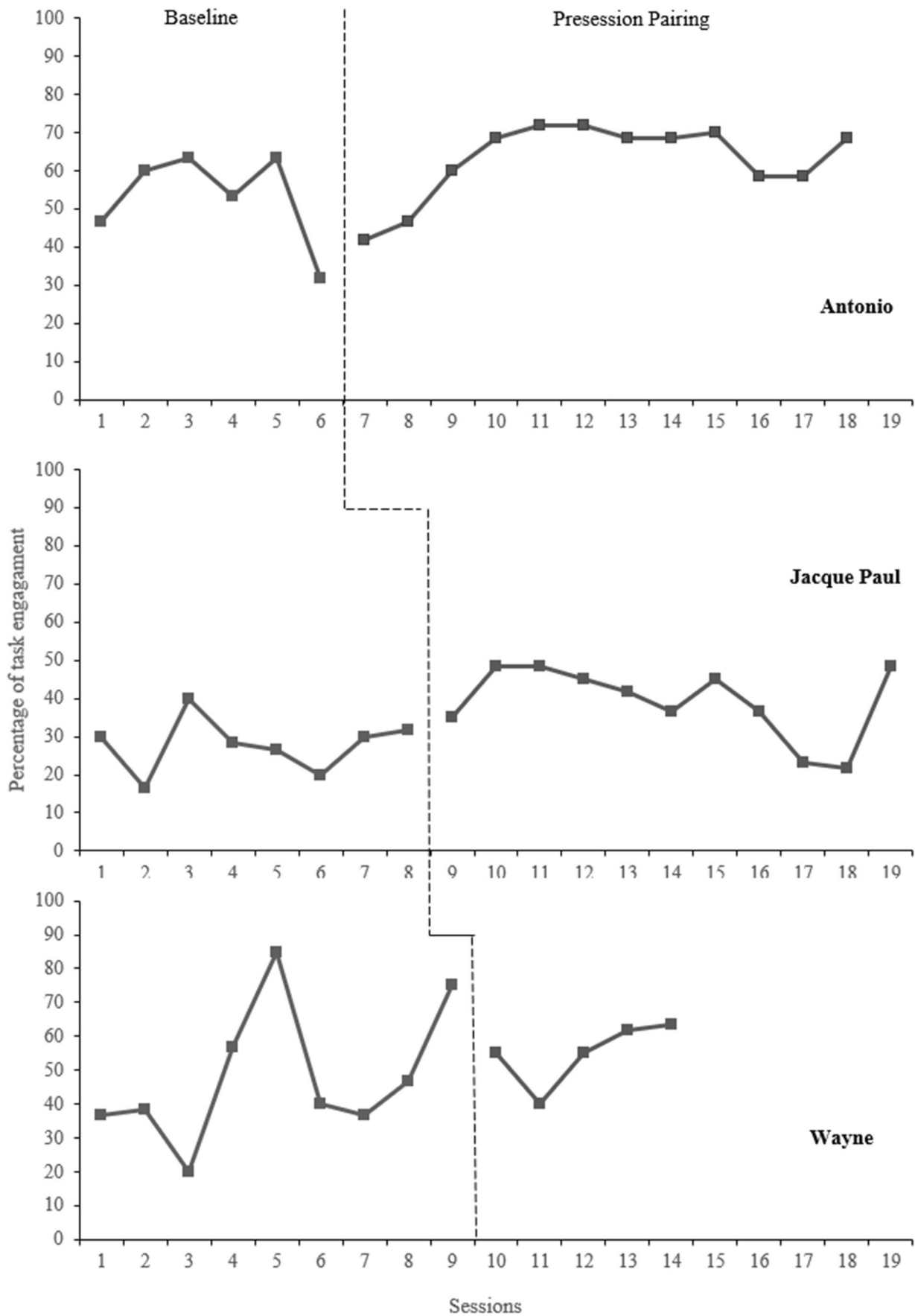
several variants that are calculated differently, which can make it difficult for researchers to select the appropriate one based on data characteristics (Fingerhut et al., 2021). Furthermore, Tarlow (2016) found that Tau-U scores were sometimes not between −1 and 1, which can lead to Type 1 errors that suggest ineffective treatments were effective.

Regardless of the discrepancy between the PND and Tau-U scores, the results indicated that presession pairing was effective in improving the idiosyncratic mood indicators of all three children. This suggests that there was an increase in their happiness and overall QoL during DTT. It is possible that presession pairing led to satiation with the preferred item or activity, which served as an abolishing operation for escape-maintained behavior and unhappiness during subsequent DTT sessions (Kelly et al., 2015). However, the most likely explanation for these effects was that presession pairing indicated an improvement in therapeutic conditions rather than a worsening, as the tutor was established as a strongly conditioned reinforcer (Lugo et al., 2017). This would suggest that presession pairing changed the tutor's role as a possible CMO-R that was associated with a worsening of conditions to being associated with meaningful and effective reinforcement (Kelly et al., 2015).

While DTT is an evidence-based practice that has been found to be highly effective in teaching a variety of skills to young autistic children (Hume et al., 2021), it is a highly structured, teacher-led approach with a fast-paced format of instruction that may be too demanding for some autistic children (Geiger et al., 2012). This may result in DTT sessions becoming aversive for these children, which can undermine instruction and hinder skill acquisition. Given the importance of DTT for developing certain communication and academic skills, researchers have explored ways to reduce the aversiveness of DTT sessions and increase learner motivation. A number of antecedent-based interventions have been found to be effective, including presession pairing (Carbone et al., 2010).

A secondary variable that was measured during this study was task engagement. PND scores suggested that presession pairing had no effect on academic engagement ($M = 37.6\%$, range: 0–58.3%). Meanwhile, the omnibus Tau-U score for task engagement was 0.5, which indicated a moderate effect. This supports the findings of Kelly et al. (2015), who found a modest effect of presession pairing on academic responding. Similarly, Gormley et al. (2020) reported a small effect on life skills acquisition. This is in contrast to McLaughlin and Carr (2005), who found a significant increase in task completion when participants completed tasks in the presence of individuals with whom they had a good rapport. One possible explanation for the small improvements in task

engagement is that the operational definition of this behavior was not as stringent as previous research. Task engagement was marked if participants engaged in the task within 5 s of the instruction, regardless of the accuracy of their responses.

Limitations and Future Research

There are some methodological limitations that need to be considered when interpreting the results of this study. First, the findings should be interpreted with caution as there were a limited number of participants ($n = 3$). There were also a limited number of intervention sessions because of the school's early closure. Due to the ongoing COVID-19 pandemic and related time constraints, the intervention was only implemented for 5–12 sessions with each participant. Further research is needed to examine the effects of presession pairing on the mood of autistic children when it is applied long term. Additional research with more autistic participants and participants with other developmental disabilities is also warranted to improve the generalizability of the results.

Other limitations was related to the fidelity and validity of the procedures. While Lugo et al.'s (2017) protocol was referred to, the current study did not use behavioral skills training with performance feedback to standardize the presession pairing procedure like previous research (e.g., Gormley et al., 2020; Lugo et al., 2019; Shillingsburg et al., 2019). However, these studies examined the effects of presession pairing on outcomes such as life skills acquisition rates, pre-attending skills, and problematic behaviors. As the current study focused on the effects of presession pairing on happiness and overall QoL, procedural fidelity was not considered a critical variable. This could be examined in future research, as it is possible that implementing presession pairing with high fidelity could result in better improvements in mood during DTT. Another limitation was related to the operational definitions of the indices of happiness and unhappiness. Although these definitions were approved by the adults familiar with each child, a rating scale was not implemented to confirm agreement or disagreement with each definition. This should be considered in future research.

Another possible limitation was not accounting for individual differences in presession pairing. For instance, 10 min of presession pairing might be enough to have abative effects on indices of unhappiness and off-task behavior for one participant, whereas another participant might require more rapport building. It is also possible that 10 min of access to preferred items and activities had an evocative effect on disruptive behaviors (Scalzo & Davis, 2016), which could have reduced the overall effects of presession pairing on task engagement. The presession pairing sessions were also shorter in duration than the DTT sessions. Future research should examine the effects of presession pairing when it is

conducted for the same duration as the teaching sessions or for longer durations.

It is also important to note that Antonio's presession pairing and reinforcement during DTT involved tickling while he was on the hammock chair. As laughter is considered an automatic emotional response to being tickled (Wattendorf et al., 2013), this could have inadvertently increased his happiness indices during DTT sessions. A final limitation was potential researcher bias. Although the reliability of the measures was ensured through IOA, both the researcher and the second observer worked at the Montessori school and they were not blind to the conditions.

In conclusion, the present study demonstrated that presession pairing can increase the overall mood of young autistic children during DTT sessions. This suggests that presession pairing decreased the aversiveness of DTT, which is an instructional technique that is often needed to teach early skills to this population. Although only small improvements in task engagement were observed, all three participants were deemed to be happier during the DTT sessions that were preceded by pairing. As an improved QoL is considered to be the most important measure of social validity, the findings of this study suggest that presession pairing is a socially valid intervention that can be incorporated into the daily routine of young children on the autism spectrum.

This study also demonstrated the efficacy of using an abbreviated procedure for identifying and validating the individualized mood indicators of young autistic children. As this was a more systematic and time-efficient approach as compared to previous research, this could be considered a more acceptable method for objectively evaluating the QoL of service recipients during behavioral interventions. In turn, this technology could be used to objectively assess the efficacy and social validity of such interventions. If an intervention increases precursor indicators of unhappiness (e.g., frowning, crying), adjustments could be made to prevent behavior escalation. By identifying the more innocuous unhappy indicators in the learner, educators have a proactive approach to preventing or reducing severe challenging behaviors such as self-injury or aggression. However, additional replications are needed to establish the external validity of this abbreviated procedure for identifying the idiosyncratic mood indicators of different populations and across various settings.

Declarations

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