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Mixed-Methods Article

Developing and Assessing Positive Reinforcers to Understand Learning Behavior of Children with Autism Spectrum Disorder in Malaysia

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Abstract

Background: This study makes a significant contribution to the field of behavioral science by developing and validating a measurement instrument for assessing the positive reinforcers of autism spectrum disorder (ASD) children. The newly developed instrument is intended for implementation in National Autism Society of Malaysia (NASOM) centers, addressing the crucial need for a validated tool to assist educators in identifying positive reinforcers for children ASD effectively.

Objective: This study aimed to develop and validate the measurement instrument for assessing the positive reinforcers of children with ASD diagnosis.

Design and Methodology: A total of 97 parents of children with ASD diagnosis from four NASOM centers in Selangor participated in the study, using a simple random sampling method. The methodology involved developing, validating, and assessing positive reinforcers for Children with ASD diagnosis. Exploratory factor analysis, reliability analysis, and preference index were employed with the developed questionnaire.

Results: Construct validity demonstrated good instrument validity (KMO = .74, $p < .001$), while the instrument's reliability was also consistent ($\alpha = .95$). The top preferences are indoor activities specifically on sensory toys, with a preference index of 77.10.

Conclusion and Implications: The preference index reflects the preferences of children with ASD diagnosis involved in this study. This research offers a valuable tool for teachers and caretakers of children with ASD diagnosis, enabling a better understanding of their preferences and behavior to improve management and educational processes.

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Autism, positive reinforcers, preference, instrument development, validation.

Originality/Value for the Sustainable Development Goals (SDGs)

This study advances behavioral science knowledge and supports the SDGs by enhancing understanding of children with ASD diagnosis's behaviors, addressing SDG-4 (quality education) by tailoring educational strategies to individual needs, and supporting SDG-10 (reduced inequalities) by promoting inclusive settings.

Autism spectrum disorder (ASD) is a neurodevelopmental condition marked by differences in how individuals communicate socially, as well as the display of repetitive behaviors and challenges in

processing sensory information (Kojovic et al., 2019). According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013), ASD is defined by three main characteristics. Firstly, interacting with others is challenging, which can involve trouble using nonverbal cues like eye contact, facial expressions, and gestures during regular social situations. Secondly, there can be problems with communication, such as having speaking ability later than usual or not speaking at all, and challenges in starting or maintaining conversations. Lastly, there is a tendency towards repetitive and restricted behaviors, interests, and activities. This might include sticking rigidly to specific routines or rituals, even if they do not have a clear purpose.

In Malaysia, data from the Health Ministry in 2014 showed that the prevalence was 1.6 in 1,000. The number of ASD-diagnosed children in Malaysia has increased by five per cent, from 562 in 2020 to 589 in 2021. The lifetime cost of education, health and other intervention and service needs for a child with ASD ranges from US$1.4 million to US$2.4 million, depending on the child's severity and prognosis (Ong, 2023). To support families affected by autism, NASOM was established in 1986. Comprising parents and professionals, NASOM provides comprehensive services to individuals with autism. Officially registered in 1987 as a national charitable organization, NASOM aims to offer diverse support tailored to help individuals, especially children, navigate the complexities of autism.

Various interventions have been developed for children with autism, resulting from different theoretical frameworks. These methods include behavioral, developmental, and cognitive-behavioral strategies. Warren et al. (2011) conducted a systematic review indicating that a global consensus on the most effective treatment strategies for individuals with ASDs is still pending; hence, ongoing management is crucial for enhancing independence and overall well-being.

This study focuses on assessing the positive reinforcers of children with ASD diagnosis by using the developed and validated measurement instrument. There is limited research evaluating specific positive reinforcers that are effective in different contexts and settings for children with ASD. In addition, it is found that different ASD centers use different reinforcement forms, making them inconsistent and standard. Therefore, this study intends to provide educators and caregivers with a reliable tool to gain insights into the unique characteristics and needs of children with ASD diagnosis, ultimately enhancing the quality of education and support provided to them. To achieve this, the study utilizes the reinforcement checklist form as a valuable tool to aid teachers and caregivers in comprehending the preferences and behaviors of children with ASD diagnosis. This instrument is expected to contribute significantly to improving educational strategies and interventions tailored to the individual needs of children with ASD, fostering their overall development and well-being.

Literature Review

Behavioral science plays a vital role in understanding and addressing the needs of children with ASD, mainly through the application of operant conditioning principles. Operant conditioning focuses on how consequences shape behaviors, with reinforcement being a critical mechanism for promoting desired behaviors (Skinner, 2014). In this context, reinforcers are stimuli that increase the likelihood of a behavior being repeated when applied after a particular action. For children with ASD, carefully selecting and implementing reinforcers or tangible rewards (e.g., toys or snacks), social praise, or sensory stimulation helps encourage positive behaviors such as communication and social interaction while reducing challenging behaviors.

When combined with operant conditioning, the importance of individualized reinforcers becomes even more evident. By consistently applying reinforcers following appropriate behavior, interventions like

applied behavior analysis (ABA) leverage the principles of operant conditioning to build essential life skills (Cooper et al., 2020). The integration of these behavioral science theories allows for a structured approach that is both motivating and effective in supporting children with ASD diagnosis in their development. Research shows that such positive reinforcement strategies form the foundation of evidence-based interventions that promote long-term behavioral improvement (Matson et al., 2012).

Aligned with these theoretical principles, the study examines specific reinforcers such as indoor and outdoor activities, books, and each child's unique strengths or talents. These elements serve as individualized motivators and learning tools, reinforcing desired behaviors and fostering growth in critical areas of development (Grahame et al., 2015).

Positive Reinforcers

Cooper et al. (2020) define positive reinforcement as a stimulus presented after a response that increases the likelihood of similar future reactions. In learning contexts, it involves providing a reinforcer after a learner displays a desired skill or behavior. Malaco et al. (2020) categorize positive reinforcers into primary (essential needs like food and comfort) and secondary (verbal praise, desired activities, stickers, toys, and treats). Preference is the subjective inclination or aversion towards specific items or activities. Evaluating preferences among individuals with developmental impairments is crucial for implementing learning and behavioral interventions. Using a child's interests to boost motivation is an essential strategy for children with autism, who often show reduced engagement with their environment (Keen, 2009).

Indoor and Outdoor Activities

Sensory activities are common among individuals with ASD. Thus, indoor activities can be tailored to accommodate these sensitivities. According to Hilton et al. (2007), sensory processing challenges have been extensively observed in children with ASD diagnosis. Few studies have recognized difficulties related to sensory modulation in children with autism, encompassing both diminished sensitivity (hyposensitivity) and heightened sensitivity (hypersensitivity) to various stimuli (Liss et al., 2006). Outdoor adventure programs offer therapeutic benefits for individuals with disabilities, enhancing self-esteem, personal growth, and social adaptability (McAvoy et al., 2006). Research indicates that outdoor education is particularly beneficial for children with ASD, improving social interactions and speech skills and reducing inappropriate behaviors (Miltenberger et al., 2014). Therefore, sensory-friendly play, which includes engaging in indoor activities such as interacting with sensory bins containing materials like rice, beans, or sand, enables children with ASD to explore various textures and sensations safely within a controlled environment. In addition, exposure to outdoor environments can help children with ASD develop tolerance levels, support effective adaptation, and positively influence their emotions by reducing sensitivity to certain stimuli.

Books and Gadget Activities

The children with ASD display a spectrum of reading abilities, ranging from adept word recognition to difficulties in comprehension. According to Grandin (2006), individuals with autism excel in visual and spatial skills, finding verbal information more abstract than concrete. Visual aids are crucial in teaching and learning with these children. Studies by Tabernero and Calvo (2019) highlight the struggles children with ASD diagnosis face in understanding written texts and how picture books can effectively captivate them. Picture books aid in improving their oral and written skills, emotional comprehension, and empathy, contributing to holistic social development.

Gadgets have the potential to assist children with autism in enhancing their cognitive abilities and facilitating behavioral training (Gupta, 2020). In some circumstances, technological devices allow youngsters diagnosed with autism to respond to various situations since particular gadgets can extract

knowledge of emotional responses. The device can measure youngsters' cognitive and affective states using acquired information. Consequently, this education can foster a positive and contended atmosphere among individuals. Gadgets encourage character development in Indonesian kindergartens, wherein preschool-aged children are engaged in activities that promote spiritual, personality, social, and environmental growth (Saptatiningsih & Permana, 2019).

Favorite Videos and Pets

Video technology, which involves capturing and showcasing dynamic visual content through different mediums like film, electronic signals, and digital media, is defined as filming a role model to teach ASD students (Saiman et al., 2013). Video modelling has been suggested as an effective method for educating individuals with autism. Jowett et al. (2012) recommended using video to support education in students with autism. Furthermore, videos can be valuable in teaching various social and functional skills. Previous research has shown that videos are beneficial in fostering learning among Children with ASD diagnosis, particularly in behavioral, social, and communication skills (Saiman et al., 2013).

Animal-assisted intervention (AAI), including therapy and activities involving animals, has proven beneficial for individuals with ASD. Animals help alleviate social isolation and can be more comforting than human interactions for those with ASD, as research shows a preference for animal pictures over humans or objects (Prothmann et al., 2009). Since the late 18th century, AAI has demonstrated positive effects across different clinical groups, enhancing physical and psychological well-being in Alzheimer's patients and improving social functioning in various disorders. Moreover, significant improvements in social skills have been reported by parents and teachers after just two months of animal engagement (O'Haire et al., 2014).

Unique Talents or Strengths

Children with ASD often encounter challenges expressing imaginative thinking through creative writing and reading (Zajic & Wilson, 2020). Focusing on their strengths and using factual questions becomes crucial to aid their learning. Teaching reading should start by aligning with their interests, such as creating cartoon strips with captions. Just like typical children, those with ASD have unique interests that can hold their attention during learning activities for more extended periods. These interests are more than hobbies; they are fundamental to their overall well-being, serving as a primary way for learning, skill development, and social connection.

Research Objectives

This study aimed to fulfil the following objectives:

1. Develop a measurement instrument to identify the positive reinforcers of children with ASD diagnosis.
2. Validate the accuracy and effectiveness of the developed measurement instrument.
3. Assess the positive reinforcers of children with ASD diagnosis using the developed instrument.

Method

Research Design

This mixed-methods study was divided into three different phases. In Phase 1, the focus was on theoretical importance through literature review and discussion with experts to identify the children with ASD diagnosis's motivators and reinforcers. In Phase 2, face and content validity was conducted to confirm the validity of the factors included in the instrument. In addition, statistical analysis was performed to assess the construct validity and reliability of the instrument items. Meanwhile, in Phase 3, the developed and validated items in the instrument are used to determine the preferences of children with ASD diagnosis in NASOM.

Participants

The study involved a sample of 156 parents of children diagnosed with ASD registered at four NASOM centers in Selangor, Malaysia. To ensure the sample size met the study's requirements, 97 parents were selected using a simple random sampling technique.

Instruments

Data was collected using a questionnaire that is divided into seven main factors. The factors include indoor and outdoor activities, books, gadgets, favorite videos, favorite pets, and unique strengths or talents. Each factor had multiple items, and each item had a five-point Likert scale ranging from "definitely not", "probably not", "neutral", "probably", and "definitely". Respondents must state their children's liking for each item based on the scale.

Procedures

This study was divided into three phases: instrument development, instrument validation, and preference assessment among children with ASD diagnosis.

Phase 1: Development of Measurement Instrument

During this phase, items were conceptualized and developed using inductive and deductive approaches. In addition to analyzing existing literature, the instrument's development was also facilitated by focus group discussion. The questionnaire items were developed based on the procedure outlined in The Strategies for Teaching Based on Autism Research (STAR) curriculum (Arick et al., 2015), which is renowned for customizing the national curriculum to cater to students with ASD across various subjects.

Phase 2: Validation of Measurement Instrument

Four NASOM teachers and two NASOM coordinators who had good experience in the topic were identified to ascertain the content and face validity of the instrument. Their expertise was necessary to determine whether the items included were relevant to the study's purpose. The people from NASOM were able to evaluate whether the questionnaire successfully captured the intended topic of the survey. In addition, the instrument was assessed for clarity and accuracy in capturing ASD student's preferences.

The exploratory factor analysis (EFA) was carried out to determine the instrument's construct validity. Before the extraction of factors, the Kaiser – Meyer – Olkin (KMO) measure of sampling adequacy was checked to evaluate the fitness of the data for factor analysis. The number of factors selected will depend on several criteria, including Eigenvalue > 1), factor loading coefficient > .40, and the cumulative percent of variance extracted (Ondé & Alvarado, 2020).

The reliability of each factor was assessed by calculating Cronbach's Alpha. Saifuddin et al. (2023) suggests that reliability coefficients ranging from .70 to .90 are acceptable. The Cronbach's Alpha coefficient of .95 indicates strong internal consistency and reliability in assessing intended constructs.

The EFA results were validated through CFA which tests predefined hypotheses about the relationships between variables based on established theoretical frameworks or assumptions (Schumacker & Lomax, 2016). To evaluate the model's fit, CFA employs several indices, including the comparative fit index (CFI), Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). These indices compare the model's fit to a baseline model. According to the literature, an RMSEA below .08 is acceptable (Hu & Bentler, 1999), while values above .90 for CFI and TLI indicate a good model fit (Hooper et al., 2008).

Phase 3: Assessing the Positive Reinforcers of Children with ASD diagnosis

The preference indexes were calculated by adapting the formula of the relative importance index (Johnson et al., 2004). The questionnaire items are arranged based on their preference index values from

the highest to the lowest in each specific factor. An item with a high preference index indicates that Children with ASD diagnosis favor that particular item.

Data Analysis

This study assessed the positive reinforcers for children with ASD diagnosis by calculating the preference index for each item, ranking them based on their mean values. This comprehensive approach ensured the instrument's validity and reliability, providing a robust tool for understanding the preferences and behaviors of children with ASD diagnosis.

Results

The acquired results are derived from the study's methodology and aligned with its objectives. Initially, a questionnaire was developed and distributed to study participants to achieve the first objective, which was the instrument development phase. Next, a descriptive analysis was conducted to outline the demographic characteristics of the respondents. Following this, the constructed instrument underwent validation, including face validity, content validity, construct validity, and reliability assessment, to fulfil the second objective. Lastly, to achieve the third objective, the study evaluated the positive reinforcers for children with ASD diagnosis by calculating preference indexes for each item in the instrument.

Descriptive Analysis

A total of 156 questionnaires were distributed to four NASOM centers using the simple random sampling method. However, only 97 parents (62.2%) successfully returned the questionnaires. Table 1 shows the distribution of the respondents by NASOM centers and gender. The highest respondent participation was from NASOM Titiwangsa, with 40 parents (41.2%), and the least was from NASOM Setia Alam, with 17 parents (17.5%). 78.4% were parents of male students, while 21.6% were parents of female students.

Table 1

Demographic Profile of the Respondents

NASOM Centers	Frequencies (%)	Gender	Frequency (%)
Gombak	22 (22.7)	Male	76 (78.4)
Setia Alam	17 (17.5)	Female	21 (21.6)
Teluk Pulai	18 (18.6)		
Titiwangsa	40 (41.2)		
Total	97 (100)	Total	97 (100)

Exploratory Factor Analysis and Reliability Analysis

The results in Table 2 show that Bartlett's test is significant, and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) value of .74 indicates the adequacy of the sample size, making factor analysis plausible.

Table 2

The Results of KMO and Bartlett's Test of Sphericity

KMO		.74
Bartlett's Test of Sphericity	Approximate Chi–Square	3842.13
	Degree of Freedom	1431
	p–value	< .001

As shown in Table 3, seven factors were extracted after the construct validity was conducted. Factor loading value for all items is greater than .40, ranging from .41 to .75. Indoor activities accounted for the highest variance (30.13%), followed by outdoor activities (7.64%) and books (5.70%). Gadget activities,

favorite videos, favorite pets, and unique strengths/talents contributed 4.28%, 4.10%, 3.70%, and 3.38% of the total variance, respectively. The eigenvalues for all seven factors range from 1.82 to 16.27, surpassing the threshold value of 1.0. In total, the extracted factors elucidated 58.90% of the total variance. Additionally, the Cronbach's Alpha values for the study's factors surpass .70, confirming the questionnaire's reliability.

Table 3

The Results of Exploratory Factor Analysis (EFA) and Reliability Testing

Items	Factor Loading							Dimension
Puzzles	.60							Indoor Activities
Games	.51							
Books	.57							
Sensory toys	.49							
Musical instruments	.42							
Computer games	.57							
Action figures	.42							
Painting/drawing	.63							
Indoor sports	.53							
Acting rough	.49							
Bicycle riding		.41						Outdoor Activities
Using a trampoline to jump		.48						
Swimming		.41						
Swinging the bat		.54						
The sliding game		.60						
Pool balls		.59						
Merry go round		.68						
Bouncing castle		.64						
Pop-up books			.75					Books
Picture books			.75					
Books with sound cards			.68					
Sensory books			.69					
Puzzle books			.73					
Coloring books			.62					
Sticker books			.64					
Tablet				.46				Gadget Activities
Smartphone				.41				
Computer/laptop				.45				
Online/Offline games				.65				
Watching YouTube				.46				
Watching news				.49				
Painting/drawing				.53				
Playing games				.60				
Playing online games				.59				
Playing offline games				.61				
Browsing internet				.52				
Disney movies					.60			Favorite Videos
Animation movies					.61			
Cartoons					.50			
Real-life animal videos					.67			
Cats						.52		Favorite Pets
Dogs						.54		
Hamster						.53		
Fish						.55		
Bird						.57		

Table 3 *(Continued)*

Items	Factor Loading							Dimension
Arts							.72	Unique Strength/Talent
Number							.64	
Musical instrument							.58	
Solving Rubik's cube							.54	
Reading							.54	
Computer							.61	
Photographic memory							.52	
Singing							.63	
Sports							0.53	
Total % of variance	30.13	7.64	5.67	4.28	4.10	3.70	3.38	
Eigenvalue	16.27	4.13	3.06	2.31	2.21	2.00	1.82	
Cronbach's Alpha	.78	.81	.89	.84	.75	.84	.86	

Confirmatory Factor Analysis (CFA)

Two models were developed using CFA, with the first including all seven factors comprising 54 items in the instrument. However, this initial model exhibited poor fit statistics, with CFI = .58, TLI = .55, and RMSEA = .10, indicating the need for adjustments. Subsequently, a second model was developed with the same number of factors, but items showing weak factor loadings (< .60) were removed. The adjusted model showed improved fit statistics, with CFI = .83, TLI = .81, and RMSEA = .09. Table 4 below is the comparison between the original and adjusted model.

Table 4

Model Comparison

Models	Chi-Square (χ^2)	*df*	*p*	CFI	TLI	RMSEA
7 factors	2791.65	1356	< .001	.58	.55	.10
7 factors with removed non-contribute items	695.61	384	< .001	.83	.81	.09

These results suggest that the adjusted model outperforms the initial model, as evidenced by the higher CFI, TLI, and reduced RMSEA, indicating a better fit to the data. The adjusted CFA model is shown in Figure 1.

Assessing the Preference of Children with ASD diagnosis

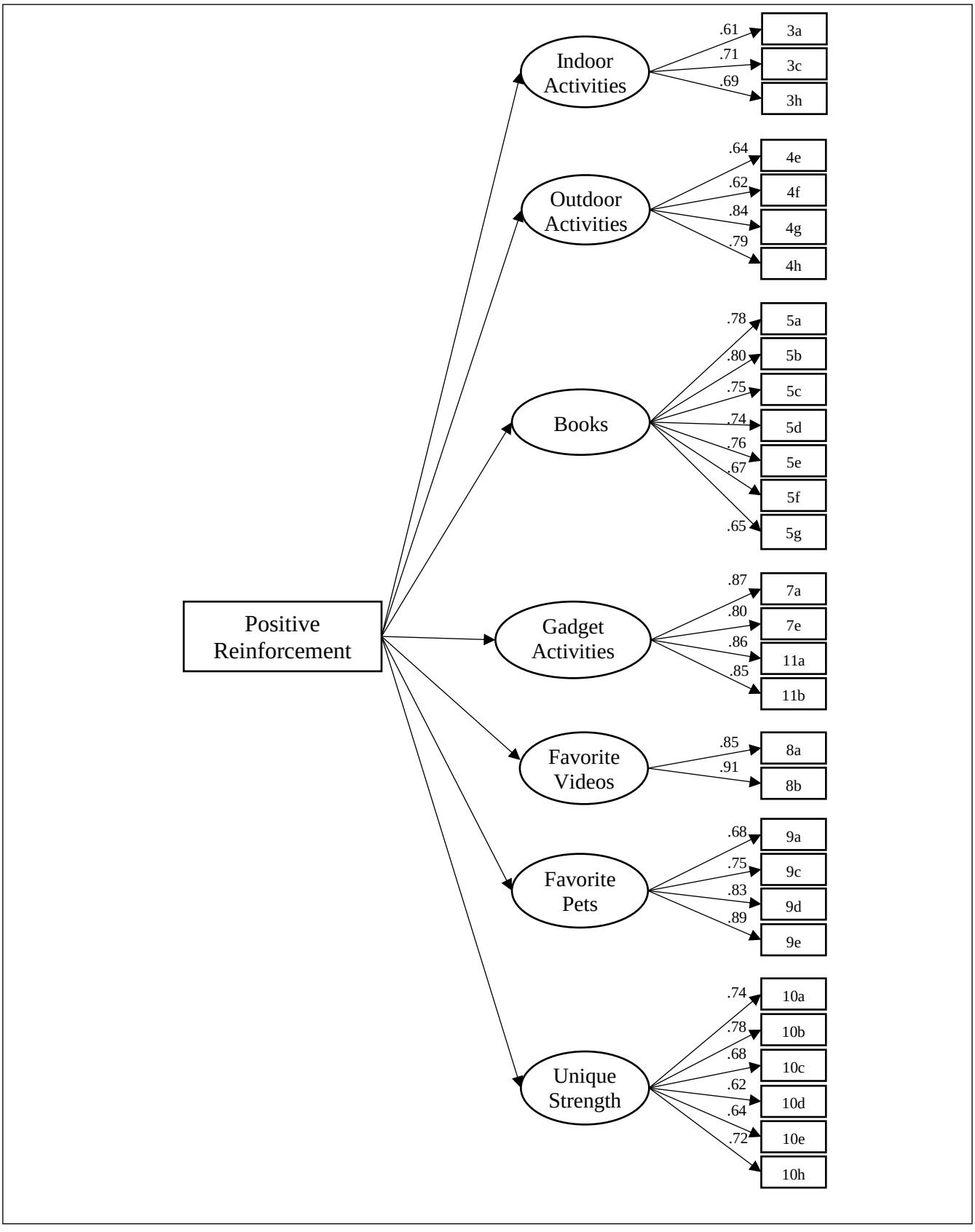
The index of children with ASD diagnosis's preferences was calculated from the respondents' scores of the answered questionnaires. The top preferences in indoor activities are sensory toys, with a preference index of 77.1, followed by musical instruments, with a preference index of 76.4, and drawing, with a preference index of 72.3.

Among children with ASD, trampoline jumping is the most preferred outdoor activity, with a preference index of 88.8, followed by swimming at 86.9 and sliding at 81.2. Books equipped with sound cards are the most favored, with a preference index of 80.6, followed by picture books at 80. Sensory books and sticker books have preference index values of 74.4 and 73.8, indicating their comparable popularity among this group.

The preferred activity among children with ASD diagnosis when using a gadget is watching YouTube, with a preference index score of 91.9, the highest score across all factors. The study also shows that many children with ASD diagnosis prefer smartphones over tablets and computers, with index scores of 88.9, 77.2, and 62.7, respectively. On the other hand, watching the news is the least desired activity, with a preference index score of 34.3. The study also identifies the preferred types of videos among children with ASD diagnosis, with cartoons being the most favored (85.7), followed by animation movies (72.6),

Disney movies (70.3), and real-life animal videos (66.4). In terms of favorite pets, cats are the most beloved with a preference index value of 65.2, followed by fish (61.9), birds (58.4), and hamsters (46.6), while dogs rank last with a preference index of 42.6.

Figure 1
Adjusted Seven-factor Model



The instrument used in this study also measures the index of unique strength portrayed by children with ASD diagnosis that is involved in this study. Most Children with ASD diagnosis in this study excel with numbers, with an index of 69.2. Next, many children with ASD diagnosis among the respondents also excelled with musical instruments and had good photographic memory, with the same index of 67.4. Other unique strength possessed by children with ASD diagnosis includes arts (65.8), singing (65.1), sports (61.2), dealing with the computer (57), reading (50.1), and solving Rubik's cube (45.2).

Discussion and Conclusion

Discussion of Main Results

This study aimed to assess and validate the positive reinforcers of children with ASD in Selangor. This study's instrument is crucial for helping teachers understand and address positive reinforcers for children with ASD. In addition, this assessment tool is vital for giving teachers insights to create customized lessons for children with ASD diagnosis at NASOM centers in Malaysia. This tool enhances classroom management and improves educational experiences and outcomes for children with ASD diagnosis, ultimately aiming for better education quality in NASOM centers.

This study's primary method to validate the constructs related to positive enforcers for children with ASD was conducted using EFA. The suitability of EFA had already been confirmed through the KMO statistic and Bartlett's test of sphericity, both of which are key indicators in factor analysis. With a KMO score of 0.740, the sampling adequacy falls within the favorable range, ensuring that the data was appropriate for factor analysis. This indicates that the variables shared enough common variance, making the analysis reliable. Similarly, the significant result from Bartlett's test of sphericity confirmed sufficient correlations between the variables, further validating the application of EFA. These results reinforce the validity of the factor structure identified and suggest that the instrument effectively measures the constructs as intended. This adds confidence in using this tool for understanding positive reinforcers in children with ASD, as it has proven to be both reliable and suitable for the population being studied.

The initial CFA included all 54 items across seven factors, but not all items contributed well to the model. To improve the model fit, items with low factor loadings were removed. This refinement process significantly improved the model's fit, with CFI = .83, TLI = .81, and RMSEA = .09. Although these values are still slightly below ideal thresholds (with CFI and TLI typically aimed to be above .90), the improvements show that the refined model better represents the underlying data. This refinement highlights the importance of adjusting models when some items do not perform as expected. By removing weaker items, the model becomes more accurate in capturing the key constructs. The improved fit statistics suggest the revised model is more reliable and better aligned with the actual data, which helps provide more precise insights into the measured factors.

This study has identified seven critical criteria for assessing positive reinforcers in children with ASD. These criteria include indoor and outdoor activities, favorite books, gadget use, videos, pets, and unique strengths. While the checklist proved effective, it's vital to explore additional forms of reinforcement that may further enhance outcomes in social and communicative behaviors. Recent studies have shown that social reinforcers, such as praise or direct engagement, remain highly effective in improving social skills in children with ASD. Research by Baker et al. (2020) demonstrated that adolescents with ASD who underwent social skills interventions showed increased neural sensitivity to social rewards, indicating enhanced motivation for social interaction. This suggests that social reinforcers not only improve behavior, but can also trigger deeper neurological changes, reinforcing positive engagement in social settings. Moreover, as reviewed by Kamps et al. (2017), peer-mediated interventions have effectively enhanced social interactions by leveraging the natural dynamics of peer relationships to increase motivation and social communication skills.

Similarly, synchronous reinforcement, where stimuli such as audio or visual rewards are provided immediately during targeted behavior, effectively sustains engagement and improves socially significant behaviors in children with ASD (Stordahl et al., 2023). Combining such approaches with the checklist could make interventions more personalized, accounting for each child's unique preferences and motivators. Thus, incorporating these more dynamic reinforcers into the tool can offer a broader range of strategies that may enhance the child's development, allowing practitioners to tailor interventions to individual needs further.

In addition, the preference index was calculated based on distinct factors and the value of the index score for each item. For indoor activities, the factor that has the highest preference index is sensory toys. This agrees with a study by Elbeltagi et al. (2023), which stated that children who have been diagnosed with autism frequently prefer sensory toys, such as weighted plush animals and fidget toys. The desire to engage with these toys is based on their favorable effects on relaxing and sensory engagement, promoting positive relationships during playing.

Jumping on a trampoline has the highest index score for outdoor activities. Lourenço et al. (2015) highlighted the benefits of trampoline jumping for children with ASD diagnosis. Trampoline jumping enhances balance control, which is crucial for children's development. There is a noticeable improvement in physical strength and overall motor skills proficiency. Trampoline jumping is shown to be a fun way for children with ASD to participate in physical activity, making it a popular outdoor choice for children with ASD diagnosis. Books with sound cards are selected as the most preferred books among children with ASD diagnosis, with picture books following in the second. However, the index score difference between the two book types is not significant, with a preference score of 80.6 for books with sound cards and 80.0 for picture books. This indicates the potential of using books with sound cards to explore the advantages and benefits among children with ASD diagnosis.

In terms of gadget activities, watching YouTube has the highest preference index score (91.9), while the preferred gadget type is a smartphone (88.9), followed by tablets (77.2) and laptops (62.7). This finding is consistent with a study by Concerto et al. (2021), which found a link between ASD traits and higher smartphone usage owing to difficulties in social communication and interpersonal relationships. YouTube, the world's third most visited website, is extremely popular, with a large user base and a notable online interaction platform (Azer et al., 2018). As a result, YouTube viewing is a popular pastime among ASD youngsters, adding considerably to their participation in gadget-related activities.

According to Rosset et al. (2010), children with ASD have prolonged fixation on cartoon characters and better emotion detection abilities with cartoons than with human features. Cartoons are the top choice for favorite videos, with a preference index value of 85.7. Animation movies come in second place with a preference index of 72.6. Disney movies and real-life animal videos have preference index values of 70.3 and 66.4, showcasing the diverse choices in this category. The results support a study conducted by Iyer (2017), indicating that children with autism often show a preference for cartoons and objects over real human faces.

Children with ASD showed more prosocial behaviors when introduced to a dog, cat, or hamster than when no pet was present (Hart et al., 2018). Most Children with ASD diagnosis in the study favored having a cat as a pet, scoring 65.2 on the preference index. On the contrary, children with ASD diagnosis least prefer having a dog, with a preference index value of 42.6. This is similar to a prior study by Grandgeorge et al. (2012), which suggested that dogs can perform valuable tasks and exhibit higher levels of interactivity with humans than cats. Still, dogs also demand greater attention and care. Some parents have reported that their children with ASD may be more suited to having a cat as a companion or that a dog might not be a practical choice for their child.

Finally, it is worth noting that the children with ASD diagnosis in this study exhibited a diverse range of unique strengths, each distinct. Among the top unique strengths portrayed were numbers (69.2), musical instruments, and photographic memory (67.4). Similarly, previous studies have reported that beyond exceptional occurrences, a considerable percentage of people with ASD perform pretty well in mathematics, sometimes even better than average (Chiang & Lin, 2007).

Limitations

This study contributes valuable insights into the positive reinforcers of children with ASD diagnosis in Selangor; several potential limitations should be acknowledged. The first limitation is the sample representativeness, where this study's findings are based on a specific sample from NASOM centers in Selangor, Malaysia. This may limit the generalizability of the results to the broader ASD population, as different geographic regions or cultural contexts could influence positive reinforcer preference. The second limitation is in terms of response bias, where this study relies on self-reported data from the parents of children with ASD diagnosis. There may be a potential for response bias, where participants provide socially desirable answers or unintentionally misrepresent the positive reinforcers affecting children with ASD diagnosis.

Implications for Behavioral Science

This study carries substantial implications for the field of behavioral science, particularly in understanding and addressing the behavior of children with ASD. The developed instrument serves as a crucial resource for educators, offering insights into the specific factors that positively influence the behavior of children with ASD diagnosis in Selangor. This is particularly relevant in the context of NASOM centers in Malaysia, where tailoring educational strategies to meet the unique needs of children with ASD diagnosis is paramount. The implications extend beyond individualized teaching approaches. The assessment tool's significance lies in its potential to enhance overall classroom management, fostering a more conducive learning environment for children with ASD diagnosis. Teachers can create a setting that promotes engagement, participation, and positive behavior by identifying and leveraging positive reinforcers. This, in turn, contributes to an improved quality of education within NASOM centers, aligning with the broader goals of advancing educational experiences and outcomes for children with ASD. In addition, this study's findings offer a blueprint for designing targeted interventions and educational strategies within NASOM centers and similar settings. Educators can use this knowledge to create individualized learning plans, incorporating positive reinforcers that resonate with the specific preferences of children with ASD diagnosis. Moreover, the assessment tool's adaptability could extend its application to various educational environments, contributing to a more inclusive and practical approach to teaching children with ASD.

Conclusion

This study addresses the gap in empirical research on positive reinforcers for children with ASD, presenting a newly developed and validated reinforcement checklist form. The instrument's conceptualization, involving 54 items, underwent rigorous development and validation processes, including face and content validity, construct validity, reliability testing, and preference index assessment. Results indicate strong construct validity and overall reliability, supporting the instrument's potential replicability in Malaysia. Sensory toys and trampoline jumping emerged as favored indoor and outdoor activities, offering potential benefits for sensory integration and overall well-being. Books with sound cards and smartphones, particularly YouTube, were preferred, suggesting opportunities for educational strategies. The study also highlights the importance of recognizing and leveraging unique strengths in children with ASD diagnosis. It proposes the instrument's contributions to improving care and education standards, especially in the Malaysian context.

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Declarations

Conflicts of Interest: The authors declare no conflicts of interest.

Ethical Approval Statement: This study underwent a thorough review and received approval from the Research Ethics Committee of Universiti Teknologi MARA (UiTM), Malaysia, under the reference number REC/07/2022 (PG/MR/141), granted on 12th July 2022.

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