

Game-based Arabic Learning for Autistic Children

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Abstract

Teaching Arabic to non-native children with autism spectrum disorder (ASD) presents significant pedagogical challenges due to the scarcity of evidence-based, tailored instructional strategies. This study examines the effectiveness of a language games-based program in developing Arabic receptive and expressive language skills among children with ASD in Malaysia. A quasi-experimental pre-test/post-test control group design was employed with 17 primary school students (experimental group, $n = 9$; control group, $n = 8$), aged 7 to 10 years, with mild to moderate ASD, all verbal in their native language and enrolled in inclusive mainstream classrooms. The experimental group received a researcher-designed program of interactive language games over 30 sessions across approximately two months, while the control group continued with the school's conventional Arabic curriculum during the same period. Data were collected using a researcher-developed Arabic language skills test, demonstrating satisfactory reliability ($\alpha = 0.718$ receptive, 0.772 expressive, 0.826 overall). Post-test results revealed substantial improvements in the experimental group. Overall receptive skills increased from 14% pre-program to 90% post-program ($P < 0.001$) and expressive skills improved from 19.8% to 81.2% ($P < 0.001$). Significant gains were observed across individual skills ($P < 0.05$), with large effect sizes ($r = 0.84$ to 0.91), whereas the control group changed only marginally. These findings contribute empirical evidence to Arabic language pedagogy by demonstrating the effectiveness of interactive, game-based instruction for non-native learners with ASD and offer a replicable framework for tailored teaching in inclusive settings.

Keywords: Arabic Language Learning, Autism Spectrum Disorder, Expressive Language Skills, Language Games, Non-native Arabic Learners, Receptive Language Skills.

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that affects communication, social interaction, sensory processing and behavior. For school-aged children with ASD, language development is often one of the greatest educational challenges, particularly in structured classroom settings and second-language learning environments. Studies have shown that receptive and expressive language skills in school children with ASD do not always develop at the same pace, highlighting the need for individualized and flexible teaching approaches (1, 2). Receptive language refers to the ability to understand spoken language, instructions and meaning, while expressive language involves using words, gestures, or other forms of communication to express thoughts and needs. Many children with ASD experience difficulties in receptive language, which can in turn affect their expressive communication. Because of this close relationship, educators and specialists increasingly emphasize the importance of interventions that develop both

comprehension and communication skills together (3). In Malaysia, several studies have found that visual supports, multimodal communication, guided interaction and individualized teaching strategies can significantly improve language learning, classroom participation and student engagement among children with ASD (4, 5). These approaches are particularly important in second-language learning contexts, where children with ASD may face additional challenges such as vocabulary retention, phonological processing, symbolic understanding and transferring communication skills across languages. Therefore, language instruction for non-native learners with ASD should move beyond traditional memorization methods and instead adopt adaptive, learner-centered strategies that address diverse learning needs. The difference between receptive and expressive language plays an important role in educational interventions for children with ASD. 'Receptive language' refers to the ability to understand words, questions and

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instructions, whereas expressive language involves the ability to communicate thoughts through speaking, naming objects, or forming sentences (2). Research indicates that children with stronger receptive language skills are often better able to develop expressive communication abilities, particularly among learners with ASD (6). Malaysian studies have similarly reported that picture-based learning, guided interaction, imitation and play-based activities can effectively improve communication skills, vocabulary development and sentence production in children with ASD (6-8). Together with the evidence noted above, these approaches point to more engaging and supportive learning environments that encourage both understanding and communication.

The relationship between receptive and expressive language becomes even more important in Arabic language learning. Arabic is linguistically complex due to its distinctive sounds, rich word-formation system, grammatical inflections and script-specific vocabulary representation. For non-native children with ASD, difficulties in receptive processing may affect their ability to recognize words and understand spoken language, while expressive language challenges may limit pronunciation, sentence formation and spontaneous interaction. Therefore, teaching Arabic to learners with ASD requires carefully planned instructional approaches that support both comprehension and verbal expression at the same time.

Game-Based Learning (GBL) is a learner-centered teaching approach that uses interactive educational games to increase motivation, engagement and skill development (9). For children with autism spectrum disorder (ASD), GBL is considered especially effective because it offers structure, repetition, clear objectives and immediate feedback—elements that strongly support learning and communication development (10, 11).

Research has shown that game-based interventions can improve vocabulary acquisition, attention span, social interaction and expressive communication more effectively than traditional teaching methods (12, 13). Educational games also create enjoyable and low-pressure learning environments, which can help children with ASD participate more confidently in classroom

activities. In Malaysia, studies have similarly reported that educational games contribute positively to motivation, memory retention and classroom communication among learners with diverse educational needs (14, 15). Within inclusive classroom settings, many Malaysian teachers increasingly view educational games as a practical and flexible tool for supporting individualized learning and promoting communicative development among students with ASD.

In Malaysia, Arabic language education plays an important role in Islamic and specialized schools. However, traditional teaching approaches often depend heavily on memorization and teacher-centered instruction, which may present difficulties for children with autism spectrum disorder (ASD) (16). These methods may not adequately address the communication, attention and learning needs of learners with ASD, particularly in second-language environments.

Recent studies have shown that interactive and game-based approaches to Arabic language learning can improve vocabulary retention, motivation, classroom participation and communicative confidence using multimedia tools and active learning strategies (17, 18). Such approaches encourage greater student involvement and create more engaging learning experiences compared to conventional instructional methods.

In addition, systematic reviews have found that game-based Arabic language learning can positively support pronunciation, memory recall and learner engagement, including among students with special educational needs (19). Despite these promising findings, research specifically examining game-based Arabic instruction for non-native children with ASD is still limited. This highlights the need for further intervention-based studies that integrate language learning, communication development and adaptive teaching strategies for learners with ASD.

Conceptual Foundation and Research Gap

The present study is grounded in the fields of inclusive education, language development theory and game-based pedagogy. It is based on the assumption that receptive and expressive Arabic language skills among non-native speaking children with ASD can be significantly enhanced through structured educational games. These

games incorporate vocabulary recognition, visual association, guided verbal responses, repetition, reinforcement and communicative interaction to support language learning in an engaging and supportive manner.

By addressing both receptive understanding and expressive communication at the same time, game-based instruction provides a pedagogically flexible and theoretically meaningful approach to Arabic language learning for neurodiverse learners. Within the Malaysian educational context, where Arabic language instruction continues to hold strong importance in Islamic and specialized educational institutions and where inclusive education practices are steadily expanding, this intervention model carries both practical and theoretical value.

Accordingly, this study addresses an important gap in the existing research by examining the effectiveness of game-based Arabic language instruction for non-native speaking children with ASD. In doing so, it aims to provide evidence that contributes to Arabic language teaching practices, special education approaches and the development of more inclusive and innovative instructional methods in Malaysia.

Methodology

This study employs a quasi-experimental pilot research design to investigate the effectiveness of a language games-based instructional program in developing Arabic receptive and expressive skills among non-native children with autism spectrum disorder (ASD). Given the specialized nature of the target group and the specific institutional context, the researcher adopted a total population sampling technique. This exploratory approach encompasses all students with ASD registered at the school under study, ensuring maximum representation of the available target population while providing a foundational framework for future large-scale interventions.

The methodological approach is informed by contemporary theories in inclusive education, play-based learning and second language acquisition, particularly as they relate to neurodiverse learners. The central aim of this pilot methodology is to systematically examine how interactive and play-oriented instructional strategies can enhance

Arabic language acquisition in a supportive, inclusive classroom environment. By integrating pre- and post-testing with experimental and control groups, this approach seeks not only to evaluate the initial impact of the intervention but also to provide evidence-based insights that can guide more adaptive and inclusive language teaching practices for children with ASD.

Study Design and Participants

The present study adopted a quasi-experimental research design using a pre-test and post-test control group approach to examine the effectiveness of a language games-based instructional program in developing Arabic receptive and expressive language skills among non-native children with autism spectrum disorder (ASD). This design is widely used in intervention research with small clinical populations, where random allocation is often not feasible within a single educational setting (17, 18).

The study sample comprised 17 primary school students diagnosed with ASD, aged between 7 and 10 years, enrolled at Spectrum International School in Wilayah Persekutuan Kuala Lumpur, Malaysia, with approximate GPS coordinates 3.1665° N, 101.6828° E. The researcher employed a total population sampling technique, encompassing all students with ASD registered at the school during the study period to ensure maximum representation of the available target population. The participants were divided into two groups: an experimental group ($n = 9$) and a control group ($n = 8$).

Table 1 summarizes the demographic and clinical characteristics of the two groups. Of the 17 participants, 16 were male and one was female, all were aged between 7 and 10 years and all were placed within the mild-to-moderate range of the spectrum. Their native languages were Malay ($n = 8$), Urdu ($n = 5$) and English ($n = 4$); every child had functional speech in the native language and all were enrolled in inclusive mainstream classrooms. Fourteen participants had completed one full academic year of prior Arabic exposure and three had completed eight months, so the experimental and control groups entered the study with comparable background characteristics.

Table 1: Demographic and Clinical Characteristics of The Participants (N = 17)

Characteristic	Experimental (n = 9)	Control (n = 8)	Total (N = 17)
Age range (years)	7-10	7-10	7-10
Sex			
Male	9	7	16
Female	0	1	1
ASD Severity			
Mild to Moderate	9	8	17
Native Language			
English	2	2	4
Malay	4	4	8
Urdu	3	2	5
Functional speech in the native language	9	8	17
Prior Arabic Exposure			
One full academic year	7	7	14
Eight months	2	1	3
Placement			
Inclusive mainstream classroom	9	8	17

Note: ASD severity was taken from the clinical diagnostic report submitted to the school at enrolment. All participants were verbal in their native language; none were minimally verbal or non-speaking.

Setting of the Study

The study was conducted at Spectrum International School (Kuala Lumpur branch) in Malaysia, an educational institution that provides services for children with special educational needs, including those diagnosed with ASD.

The school follows an inclusive education approach, where students with special needs, including children with ASD, are integrated into regular classrooms alongside typically developing peers, consistent with the inclusive models described in the international literature (20-22).

Sampling Technique

A total population sampling technique was applied: all 17 students diagnosed with ASD who were non-native Arabic speakers and enrolled at the school during the study period were included, with no further selection. This approach was adopted because the eligible population at the school was small and fully accessible and it removes the selection bias that partial sampling would introduce.

Research Instruments

The study utilized two instruments. The first was an Arabic Language Skills Test, developed by the researcher to measure receptive language skills and expressive language skills. The test included multiple items covering key skills such as recognizing pictures and objects, understanding vocabulary, associating words with images, forming sentences and using conversational language. The receptive subscale carried a

maximum raw score of 21 points across six items and the expressive subscale a maximum of 23 points across five items; all scores reported below are expressed as percentages of these maxima.

The second instrument was a Language Games-Based Instructional Program, a structured educational program designed by the researcher, based on interactive and play-based learning strategies aimed at improving Arabic language skills. Its structure followed established principles of play-based and game-based instruction for children with ASD, in which repetition, visual support, clear objectives and immediate reinforcement are combined within short, predictable activity cycles (9, 17).

Validity and Reliability

The reliability of the language skills test was verified using internal consistency measures (Cronbach's alpha), showing acceptable levels of reliability, ensuring the consistency and accuracy of the measurement tool. Coefficients were $\alpha = 0.718$ for the receptive subscale, $\alpha = 0.772$ for the expressive subscale and $\alpha = 0.826$ for the instrument as a whole.

Furthermore, the content validity and suitability of the proposed language games program for non-Arabic speaking children with autism spectrum disorder (ASD) were established through expert judgment. The program was reviewed by a panel of specialists in early childhood education, linguistics and special education to ensure its appropriateness and effectiveness for the target population.

Procedure

The study was conducted in the following stages:

- a) pre-test administration for both experimental and control groups to assess baseline language skills;
- b) implementation of the language games-based program with the experimental group over a period of approximately two months (30 sessions);
- c) the control group received traditional instruction during the same period; and
- d) post-test administration for both groups to measure improvement.

Throughout the intervention period the control group continued to follow the school's established Arabic curriculum for non-native speakers, delivered by the regular class teacher in the same classroom, over the same number of weeks and with the same weekly contact time as the experimental group. That curriculum is textbook- and repetition-based, relying on teacher-led presentation, oral drilling and written exercises and it contains no game-based or play-based component.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). Both descriptive and inferential statistical methods were employed, including the Mann-Whitney U test to compare groups, the Wilcoxon Signed-Rank test for pre-post comparisons within groups, the independent samples t-test and the paired samples t-test. With regard to the heterogeneity of the sample, all participants were verbal in their native language and their diagnostic reports placed them within the mild-to-moderate range of the spectrum, so the range of communication profiles represented was comparatively narrow; no minimally verbal or non-speaking child was enrolled. Given this narrow range and the small number of participants, subgroup analyses by severity level, native language or duration of prior Arabic exposure were not statistically justifiable and were

therefore not attempted. Non-parametric tests were used for sub-skill comparisons scored on narrow ordinal scales, so that no assumption of normality was imposed on the small and unevenly distributed item scores; parametric (t-test) analysis was applied to the aggregate receptive and expressive scores and to the two sub-skill items scored on a wider, near-continuous behavioral rating scale ("responding to simple verbal instructions"; "imitating sounds and words"), for which the normality assumption was tenable.

Ethical Considerations

Ethical procedures were followed throughout the study. Approval was obtained from the relevant institution and participation was voluntary.

Written informed consent was obtained from the parents or legal guardians of all participating children and the children's verbal assent was sought before each session; and confidentiality of data was ensured. Participants had the right to withdraw at any stage without any consequences.

Results and Discussion

A total of 17 children with autism spectrum disorder (ASD), who were non-native Arabic speakers in Malaysia, were included in the final analysis. The participants were divided into an experimental group (n=9) and a control group (n=8).

Descriptive statistics for both groups at both time points are presented in Table 2, preceding the inferential analyses that follow. The table reports the number of participants, the mean and standard deviation, the median, the interquartile range and the observed range of the receptive and expressive percentage scores for each group at pre-test and post-test. It shows that the two groups began from broadly similar baseline levels, whereas at post-test the scores of the experimental group rose sharply while those of the control group remained close to their starting values. These descriptive patterns provide the context for the significance tests reported in Tables 3 to 8.

Table 2: Descriptive Statistics for Receptive and Expressive Arabic Language Scores (%)

Group and Measure	n	Mean $\pm$ SD	Median	IQR	Range
Experimental: receptive, pre-test	9	13.23 $\pm$ 7.45	14.3	9.5-14.3	4.8-28.6
Experimental: receptive, post-test	9	90.48 $\pm$ 5.83	90.5	85.7-95.2	81.0-100.0
Experimental: expressive, pre-test	9	19.81 $\pm$ 7.16	17.4	17.4-21.7	10.9-34.8
Experimental: expressive, post-test	9	81.16 $\pm$ 11.66	78.3	76.1-84.8	60.9-100.0
Control: receptive, pre-test	8	19.05 $\pm$ 9.18	19.0	17.9-25.0	0.0-28.6

Control: receptive, post-test	8	22.62 ± 6.10	21.4	19.0-25.0	14.3-33.3
Control: expressive, pre-test	8	22.55 ± 7.70	21.7	19.0-22.8	13.0-39.1
Control: expressive, post-test	8	25.27 ± 7.70	23.9	21.7-28.8	13.0-39.1

Note: SD = Standard Deviation, IQR = Interquartile Range, n = Number of Participants, % = Percentage. Scores are percentages of the maximum attainable raw score.

Baseline Equivalence (Pre-test Analysis)

To ensure the groups were comparable before the intervention, baseline data were analyzed. No significant differences were observed in overall receptive skills between the experimental group (Median = 14) and the control group (Median = 19) at $U=19.000$, $P=0.102$, as shown in Table 3. Similarly, overall expressive skills showed no significant variance, with the experimental group scoring a median of 17 and the control group scoring 22 at $U=25.500$, $P=0.326$, as shown in Table 4. The two groups were therefore comparable on overall receptive and expressive performance at baseline. Three individual sub-skills did differ significantly: understanding basic vocabulary ($P=0.021$) and recognizing colors and shapes ($P=0.015$) among the receptive items and building simple vocabulary ($P=0.046$) among the expressive items. In each case the control group scored higher, so the experimental group entered the study from a slightly weaker position on those specific skills.

Between-group Comparisons (Post-test Analysis)

Following the implementation of the language games-based program, post-test results demonstrated a substantial statistical difference favoring the experimental group in receptive language outcomes. The experimental group achieved a mean score of 90.48 ± 5.83 , while the control group remained at 22.62 ± 6.10 ($t=23.430$, $P<0.001$), as shown in Table 5. In terms of expressive language skills, post-test analysis revealed a marked superiority for the experimental group, which recorded a median of

78 compared to 24 for the control group ($U=0.000$, $P<0.001$), as shown in Table 6.

Within-group Progress (Longitudinal Analysis)

The effectiveness of the program was further validated by measuring the internal progress of the experimental group. For receptive skills, scores surged from a pre-test median of 14 to a post-test median of 90 ($Z=-2.716$, $P=0.004$), as shown in Table 7. For expressive skills, the mean score increased significantly from 19.81 ± 7.16 at baseline to 81.16 ± 11.66 after the intervention ($t=-24.482$, $P<0.001$), as shown in Table 8. Specific gains were notably observed in speech development through singing ($P=0.016$) and basic conversational skills ($P=0.004$).

Effect sizes were large throughout. For the non-parametric post-test between-group and within-group pre-post comparisons, $r = 0.84$ and $r = 0.91$ respectively ($r = Z/\sqrt{N}$, where 0.50 is conventionally the threshold for a large effect); for the parametric between-group comparison of overall receptive scores as shown in Table 5 ($t = 23.430$, $df = 15$), the equivalent effect size was $r = 0.99$ ($r = \sqrt{t^2/(t^2+df)}$), likewise indicating a very large effect. Overall, these results indicate that the language games-based instructional program was highly effective in enhancing both receptive and expressive Arabic language skills among children with ASD. The control group also changed over the same period, but only marginally: receptive scores moved from a mean of 19.05 to 22.62 and expressive scores from 22.55 to 25.27, gains of roughly three percentage points in each domain, against gains of 77.25 and 61.35 percentage points respectively in the experimental group.

Table 3: Comparison of Pre-test Receptive Arabic Language Skills Between Experimental and Control Groups (N = 17)

Pre-program	Experimental group (n = 9)	Control group (n = 8)	Test statistic	P-value
Overall effectiveness of the proposed program in developing receptive skills (%)	14 (9.5)	19 (11.9)	19.000	0.102
Q1: Recognizing pictures and objects	1 (0.0)	1 (0.0)	36.000	>0.999
Q2: Understanding basic vocabulary	0 (0.5)	1 (0.0)	59.500	0.021*
Q3: associating pictures with spoken words.	0 (0.5)	0.5 (1.0)	46.000	0.370
Q4: understanding spatial relationships	0 (0.0)	0 (0.0)	36.500	>0.999

Q5: recognizing colors and shapes	0 (0.5)	1 (0.0)	60.500	0.015*
Q6: responding to simple verbal instructions	1 (2.0)	0 (1.5)	26.000	0.370

Note: Data are presented as Median (IQR), % = Percentage, n = Number of Participants, U= Mann-Whitney U test, Statistical significance at P-value<0.05.

Table 4: Comparison of Pre-test Expressive Arabic Language Skills Between Experimental and Control Groups (N = 17)

Pre-program	Experimental Group (n = 9)	Control Group (n = 8)	Test Statistic	P-value
Overall effectiveness of the proposed program in developing expressive skills. (%)	17 (8.7)	22 (7.1)	25.500	0.326
Q1: developing the skill of imitating sounds and words.	3 (2.0)	3 (1.8)	39.000	0.815
Q2: developing the skill of building simple vocabulary.	0 (0.0)	1 (1.4)	56.500	0.046*
Q3: developing the skill of forming simple sentences (within the limits of acquired vocabulary).	0 (0.0)	0 (0.8)	40.000	0.743
Q4: developing the skill of using simple conversational skills (within the communicative situations and learned vocabulary).	1 (1.0)	1 (2.0)	43.500	0.481
Q5: developing the skill of improving pronunciation through singing.	0 (0.0)	0 (0.0)	32.000	0.743

Note: Data are presented as Median (IQR), n = Number of Participants, U= Mann-Whitney U test, Statistical significance at P-value<0.05.

The results presented in Tables 3 and 4 demonstrate a state of statistical equivalence between the experimental group (n = 9) and the control group (n = 8) during the pre-test phase of the proposed linguistic games-based program. Regarding receptive language skills, the findings indicate no statistically significant differences between the experimental group, which scored 14 (IQR = 9.5) and the control group, which scored 19 (IQR = 11.9), with values of (U=19.000, P=0.102). Similarly, the data for expressive language skills confirms this homogeneity; no statistically significant differences were found between the experimental group at 17 (IQR = 8.7) and the control group at 22 (IQR = 7.1), with values of

(U=25.500, P=0.326). Overall, these results suggest that the two groups were comparable on aggregate receptive and expressive performance prior to the intervention. Significant differences were nevertheless present on three individual sub-skills, all favoring the control group, so the experimental group began from a marginally weaker position on those items. This initial baseline equivalence is a critical methodological requirement, as it ensures that any subsequent differences observed after the program's implementation can be confidently attributed to the effect of the program itself, rather than to any pre-existing disparities between the two groups at the outset.

Table 5: Analysis of Post-test Receptive Arabic Language Skills Between Experimental and Control Groups (N = 17)

Post-program	Experimental Group (n = 9)	Control Group (n = 8)	Test Statistic	df	P-value
Overall effectiveness of the proposed program in developing receptive skills (%)	90.48± 5.83	22.62±6.10	t= 23.430	15	<0.001*
Q1: developing the skill of recognizing pictures and objects.	3 (0.0)	1 (0.0)	0.000	-	<0.001*
Q2: developing the skill of understanding basic vocabulary.	2 (0.0)	1 (0.0)	0.000	-	<0.001*
Q3: developing the skill of associating pictures with spoken words.	3 (0.0)	1 (1.0)	0.000	-	<0.001*
Q4: developing the skill of understanding spatial relationships	2 (0.0)	0 (0.0)	0.000	-	<0.001*

Q5: developing the skill of recognizing colors and shapes	3 (0.0)	1 (0.8)	1.000	-	<0.001*
Q6: developing the skill of responding to simple verbal instructions	6.11±1.05	0.88±0.83	t= 11.249	15	<0.001*

Note: Data are presented as Median (IQR) or Mean ± SD, n = Number of Participants, df = Degree of Freedom. Statistics preceded by t are independent- or paired-samples t-tests; values preceded by Z are Wilcoxon signed-rank tests; all remaining values are Mann-Whitney U statistics, for which df is not applicable. Statistical significance at P-value < 0.05.

The statistical evidence derived from this study establishes a robust and multifaceted foundation for the efficacy of game-based linguistic instruction in addressing the complex language deficits of non-Arabic speaking children with autism spectrum disorder (ASD). A comparative analysis of the post-test results between the experimental and control groups reveals a marked difference in communicative competence. As illustrated in Table 5, the experimental group achieved a mean score of

90.48 in receptive language skills, substantially higher than the control group's mean of 22.62. This significant gap, substantiated by a T-value of 23.430 ($P < 0.001$), underscores the program's ability to enhance auditory comprehension. This superiority was not merely aggregate but extended across every sub-skill—including image recognition, fundamental vocabulary and spatial relationships—where Mann-Whitney U tests consistently favored the experimental group.

Table 6: Analysis of Post-test Expressive Arabic Language Skills Between Experimental and Control Groups (N = 17)

Post-program	Experimental Group (n = 9)	Control Group (n = 8)	Test Statistic	P-value
Overall effectiveness of the proposed program in developing expressive skills. (%)	78 (15.2)	24 (8.2)	0.000	<0.001*
Q1: Effectiveness of the proposed program in developing the skill of imitating sounds and words.	4 (0.0)	3 (1.0)	15.500	0.046*
Q2: Effectiveness of the proposed program in developing the skill of building simple vocabulary.	3 (0.8)	1 (1.5)	2.000	<0.001*
Q3: Effectiveness of the proposed program in developing the skill of forming simple sentences (within the limits of acquired vocabulary).	3 (0.5)	0 (0.8)	0.000	<0.001*
Q4: Effectiveness of the proposed program in developing the skill of using simple conversational skills (within the communicative situations and learned vocabulary).	4 (0.0)	2 (2.0)	0.000	<0.001*
Q5: Effectiveness of the proposed program in developing the skill of improving pronunciation through singing.	5 (2.5)	0 (0.0)	4.500	0.001*

Note: Data are presented as Median (IQR) or Mean ± SD, n = Number of Participants. Statistics preceded by t are independent- or paired-samples t-tests; values preceded by Z are Wilcoxon signed-rank tests; all remaining values are Mann-Whitney U statistics, for which df is not applicable. Statistical significance at P-value < 0.05.

Parallel to these receptive gains, the data in Table 6 confirms that expressive language skills underwent a similar transformation. The median score for the experimental group reached 78, compared with a control-group median of 24 ($U = 0.000$, $P < 0.001$). This leap reflects the success of structured play in stimulating vocalizations and functional communication, ranging from the imitation of sounds to the development of speech through rhythmic singing and situational conversation.

When examining the intra-group progress of the experimental participants from pre-test to post-

test, the program's impact becomes even more evident. According to Table 7, receptive language scores surged from a baseline of 14 to 90, a large increase supported by a significant Z-value of -2.716 ($P = 0.004$). This suggests that the participants rapidly bridged their comprehension gaps through the intervention. A particularly notable advancement was observed in the "response to verbal instructions" sub-skill, which climbed from a mean of 1.00 to 6.11 ($t = -19.614$), proving that organized play can effectively translate auditory input into conscious behavioral responses.

Table 7: Longitudinal Comparison of Pre-Test and Post-Test Receptive Language Skills Within the Experimental Group (n=9)

	Pre-Program	Post-Program	Test Statistic	df	P-value
Overall effectiveness of the proposed program in developing receptive skills (%)	14 (9.5)	90 (9.5)	-2.716	-	0.004*
Q1: developing the skill of recognizing pictures and objects.	1 (0.0)	3 (0.0)	-2.807	-	0.004*
Q2: developing the skill of understanding basic vocabulary.	0 (0.5)	2 (0.0)	-2.81	-	0.004*
Q3: developing the skill of associating pictures with spoken words.	0 (0.5)	3 (0.0)	-2.81	-	0.004*
Q4: developing the skill of understanding spatial relationships	0 (0.0)	2 (0.0)	-2.887	-	0.004*
Q5: developing the skill of recognizing colors and shapes	0 (0.5)	3 (0.0)	-2.762	-	0.004*
Q6: developing the skill of responding to simple verbal instructions	1.00± 1.22	6.11± 1.05	t= -19.614	8	<0.001*

Note: Data are presented as Median (IQR) or Mean ± SD, n = Number of Participants, df= Degree of Freedom. Statistics preceded by t are independent- or paired-samples t-tests; values preceded by Z are Wilcoxon signed-rank tests; all remaining values are Mann-Whitney U statistics, for which df is not applicable. Statistical significance at P-value < 0.05.

Table 8: Longitudinal Comparison of Pre-Test and Post-Test Expressive Language Skills within the Experimental Group (n=9)

	Pre-Program	Post-Program	Test Statistic	df	P-value
Overall effectiveness of the proposed program in developing expressive skills. (%)	19.81±7.16	81.16±11.66	t= -24.482	8	<0.001*
Q1: developing the skill of imitating sounds and words.	3.06± 0.88	3.94± 0.17	t= -3.249	8	0.012*
Q2: developing the skill of building simple vocabulary.	0 (0.0)	3 (0.8)	-2.719	-	0.004*
Q3: developing the skill of forming simple sentences (within the limits of acquired vocabulary).	0 (0.0)	3 (0.5)	-2.807	-	0.004*
Q4: developing the skill of using simple conversational skills (within the communicative situations and learned vocabulary).	1 (1.0)	4 (0.0)	-2.81	-	0.004*
Q5: developing the skill of improving pronunciation through singing.	0 (0.0)	5 (2.5)	-2.375	-	0.016*

Note: Data are presented as Median (IQR) or Mean ± SD, n = Number of Participants, df= Degree of Freedom. Statistics preceded by t are independent- or paired-samples t-tests; values preceded by Z are Wilcoxon signed-rank tests; all remaining values are Mann-Whitney U statistics, for which df is not applicable. Statistical significance at P-value < 0.05.

On the expressive front, Table 8 highlights that the experimental group's mean performance shifted from 19.81 to an impressive 81.16. This evolution, marked by a t-value of -24.482 ($P < 0.001$), demonstrates the efficacy of the utilized strategies in building a functional lexicon and mastering simple sentence construction. Collectively, these integrated results confirm that the proposed program did more than just meet its pedagogical objectives; it was associated with a substantial change in the communicative performance of the participating children. By transforming language acquisition from a daunting cognitive challenge

into an interactive and visually engaging experience, the program proved highly effective in elevating performance across all targeted linguistic domains.

Table 9 reports the receptive and expressive scores of each participant individually, expressed as percentages of the maximum attainable raw score, together with the change recorded between pre-test and post-test. Every child in the experimental group improved on both measures, with receptive gains ranging from 66.7 to 85.7 percentage points and expressive gains from 41.3 to 73.9 percentage points. By contrast, the control

participants remained at or close to their baseline values, with receptive changes of 0.0 to 14.3 percentage points and expressive changes of 0.0 to 8.7 percentage points. Presenting the data at the

individual level shows that the group-level effects reported above were consistent across the whole experimental group rather than driven by a small number of high responders.

Table 9: Individual Participant Scores (%) Before and After the Intervention

ID	Group	Receptive Pre	Receptive Post	Change	Expressive Pre	Expressive Post	Change
E01	Experimental	19.0	100.0	+81.0	26.1	100.0	+73.9
E02	Experimental	28.6	95.2	+66.7	19.6	60.9	+41.3
E03	Experimental	4.8	85.7	+81.0	10.9	78.3	+67.4
E04	Experimental	14.3	90.5	+76.2	17.4	82.6	+65.2
E05	Experimental	14.3	90.5	+76.2	21.7	95.7	+73.9
E06	Experimental	4.8	81.0	+76.2	17.4	73.9	+56.5
E07	Experimental	9.5	95.2	+85.7	17.4	84.8	+67.4
E08	Experimental	9.5	85.7	+76.2	34.8	78.3	+43.5
E09	Experimental	14.3	90.5	+76.2	13.0	76.1	+63.0
C01	Control	0.0	14.3	+14.3	17.4	21.7	+4.3
C02	Control	19.0	19.0	0.0	13.0	13.0	0.0
C03	Control	14.3	19.0	+4.8	21.7	26.1	+4.3
C04	Control	19.0	23.8	+4.8	21.7	30.4	+8.7
C05	Control	23.8	23.8	0.0	26.1	28.3	+2.2
C06	Control	28.6	33.3	+4.8	39.1	39.1	0.0
C07	Control	28.6	28.6	0.0	21.7	21.7	0.0
C08	Control	19.0	19.0	0.0	19.6	21.7	+2.2

Note: Scores are percentages of the maximum attainable raw score (receptive = 21 points; expressive = 23 points). Participant identifiers are anonymized.

These findings strongly suggest that when pedagogical strategies are precisely calibrated to the neurodivergent profiles of learners with ASD—prioritizing sensory-friendly interaction, intrinsic engagement and functional communication over traditional rote memorization—the pervasive barriers to second language acquisition can be substantially mitigated. This overarching success aligns with the broader global movement toward Inclusive Education, which advocates for specialized instructional modalities that respect and accommodate the unique cognitive and neurological architecture of children on the autism spectrum.

In this context, the current results resonate powerfully with a recent study in which the effectiveness of the Universal Design for Learning (UDL) framework was investigated (23). UDL is a pedagogical paradigm aimed at proactively designing flexible learning environments that cater to the needs of all learners from the outset, rather than implementing retrospective adjustments for those with disabilities. The core philosophy of UDL posits that "disability" is not a deficit within the learner, but rather a failure of instructional methods and curricula to accommodate human diversity. This framework operates on

three fundamental pillars, all of which were integrated into the current program:

- (a) **Multiple Means of Representation:** presenting information through various modalities (visual, auditory and digital) to bypass perceptual barriers;
- (b) **Multiple Means of Action and Expression:** providing students with diverse options to demonstrate their mastery of content; and
- (c) **Multiple Means of Engagement:** stimulating student interest and motivation to ensure sustained learning.

The significant improvements observed in the experimental group align with research supporting the Universal Design for Learning (UDL) framework. It was further found in that earlier review that applying UDL principles comprehensively can lead to notable gains in academic performance and knowledge acquisition among students with diverse learning needs (23). The game-based, multi-modal design of the current program closely reflects the three core principles of UDL. This approach helps create an inclusive learning environment that is responsive to the individual neurological and cognitive characteristics of children with ASD.

The improvements seen in the experimental group—where receptive scores increased from 14% to 90% and expressive scores from 19.8% to 81.2%—indicate that the structured and guided design of the language games program effectively supported learners in understanding and applying new language skills (24).

These results are consistent with research showing that structured, reinforcement-based learning environments are especially beneficial for learners with ASD. Regular positive reinforcement helps strengthen communication skills and supports the transfer of these skills to different settings and situations (25, 26).

While a recent meta-analysis reported limited effects of game-based interventions on expressive language development in general (12), the present study found substantial improvements. These gains may be explained by the culturally adapted and carefully structured design of the Arabic language games program, which provided more targeted linguistic support for learners.

These findings are consistent with those of an earlier study in which the effects of the PEAK Relational Training System on language development were investigated in ten children with ASD. Significant improvements from pre-test to post-test were reported in vocabulary use, sentence formation and understanding of verbal instructions (27).

The PEAK program is based on the Discrete Trial Training (DTT) model, a well-established, evidence-based behavioral approach that is widely recognized for its effectiveness in supporting language development among learners with ASD (28).

The present study shares several methodological similarities with the PEAK program, particularly in its use of structured repetition, multisensory input and consistent positive reinforcement to support vocalization and functional verbal communication. Both approaches also make use of visual and auditory materials to maintain learners' attention, a design choice supported by research highlighting the strong visual processing abilities often observed in individuals with ASD (29).

The significant improvements observed in the post-test results further confirm the effectiveness of the program in strengthening functional vocabulary use and language comprehension. Overall, these findings add to the growing body of

evidence supporting game-based interventions as effective tools for developing both receptive and expressive language skills in children with ASD (30).

A wider body of research highlights the effectiveness of Picture Exchange Communication System (PECS)-based instruction in improving vocabulary development and expressive communication among children with ASD (31, 32). The use of visual supports such as images, colors and flashcards in the current program is supported by evidence showing that multimodal visual tools align with the strong visual processing strengths often seen in autistic learners, thereby improving understanding and encouraging active participation in language learning tasks (33).

In addition, increased motivation and enjoyment of language learning have been reported alongside these gains, supporting findings that structured, visually engaging learning environments not only enhance language skills but also promote more positive attitudes toward learning (31).

The conclusion that children with ASD can successfully participate in mainstream educational settings, when provided with appropriate instructional strategies and inclusive learning environments, is also supported by a growing body of research demonstrating the academic and social benefits of inclusive education for autistic learners (20-22).

This perspective directly supports the present study's view that children with ASD can successfully acquire Arabic language skills in inclusive settings, as long as appropriately designed programs are in place. Such programs should consider their behavioral characteristics and be aligned with their sensory and cognitive needs (19).

Language games used in this intervention acted as supportive linguistic tools that helped participants understand Arabic sound patterns and meaning in a more manageable way, while reducing the cognitive strain often linked to traditional teaching methods. The significant improvements in object recognition and understanding of verbal instructions ($P < 0.001$) suggest that game-based learning can shift learners from passive listening to more active and meaningful comprehension (24).

These results are consistent with research showing that play-based learning approaches are often more effective than traditional methods

because they draw on children's natural motivation, lower anxiety and sustain engagement for longer periods of time (34). Child-led interactive play has likewise been found to increase attempts at vocalization and to support the use of newly learned language structures in spontaneous speech (34).

The findings of the present study are consistent with contemporary research highlighting the effectiveness of adaptive, play-based learning environments in developing communication skills among children with autism spectrum disorder (24). By using educational games tailored to individual learning needs, the intervention helped bridge the gap between receptive language understanding and spontaneous verbal expression across different social settings. It also shifted the teacher's role from a traditional instructor to a more supportive facilitator of learning.

This is supported by past research, in which an adaptive serious games-based learning environment was found to produce an overall improvement of approximately 93.45% across five key communicative skills in children with autism (35). These results closely align with the findings of the current study, reinforcing the effectiveness of educational games in teaching Arabic to non-native speaking children with ASD.

Statistical analyses showed a significant improvement in phonetic skills among participants in the experimental group after the implementation of the singing-based training program, with non-parametric tests confirming that the experimental group outperformed the control group. This improvement is attributed to the integrated nature of singing, which combines melody and rhythm to support the processing of complex auditory input and enhance phonological awareness and articulation in children with ASD (36).

These findings are consistent with a systematic review and meta-analysis in which music therapy was found to act as a "cognitive bridge" by engaging key language-related brain regions, including Broca's and Wernicke's areas (37). It also strengthens the mirror neuron system through activities such as singing, which supports joint attention and vocal imitation, ultimately leading to improvements in word pronunciation and overall linguistic fluency.

The findings of the present study confirm the effectiveness of educational drama and language

games in enhancing both conversational and general language skills among children with ASD. Drama created an interactive and engaging environment that encouraged participants to communicate with purpose, reduce social isolation and build new interpersonal connections, allowing them to apply language skills in meaningful, real-life contexts.

These results are consistent with a previous systematic review, in which theatre- and drama-based interventions involving role-play, storytelling and improvisation were found to produce significant improvements in socioemotional functioning, peer interaction and communication among children with autism (38). In addition, incorporating social inclusion strategies through play proved to be highly effective in strengthening both receptive and expressive language skills. Children with ASD were able to learn Arabic as a foreign language more successfully, showing notable progress in listening and speaking when teaching moved away from rigid, rote memorization toward a more student-centered, game-based approach.

A key factor contributing to the success of the program was the shift in teachers' attitudes and classroom practices. Before the intervention, many educators held the view that learning a foreign language was too difficult for children with ASD, which often led to their exclusion from interactive classroom activities and reduced opportunities for participation.

This is in line with past research, in which many primary school teachers were found to have limited specialized knowledge and, in some cases, negative perceptions of inclusive education, which negatively affected students' academic progress and social integration (39).

Together, these studies highlight that while positive attitudes toward inclusion are important, they are not enough on their own. They must be accompanied by proper professional training and curriculum reform in order to create truly inclusive and effective learning environments for children with ASD.

The findings of this study collectively underscore that game-based instructional design constitutes a strategic entry point for facilitating the acquisition of Arabic as a Foreign Language (AFL) among children with autism spectrum disorder (ASD). This realization necessitates a fundamental re-

evaluation of the methodological frameworks currently employed within inclusive classrooms. Transitioning toward a stimulating learning environment—one that is attuned to individual inclinations—demands a parallel investment in human capital. In this context, specialized teacher training in targeted pedagogical strategies remains the cornerstone for ensuring high-quality educational outcomes. Ultimately, the overarching goal transcends mere social 'presence' or acceptance within mainstream settings; it extends to the engineering of 'sensory-friendly' environments that resonate with the learners' unique interests. Such a shift transforms the classroom into a dynamic platform for linguistic interaction and social development, thereby advancing the academic empowerment and social integration of this neurodivergent group.

Conclusion

This study reveals that the integration of language games-based instructional programs is a transformative approach for enhancing both receptive and expressive Arabic language skills among non-native children with autism spectrum disorder (ASD). The findings underscore that traditional rote learning is often insufficient for this population, whereas play-based, structured interventions significantly bridge the communicative gap and foster higher levels of engagement. While the results provide valuable insights into neurodiverse pedagogy in the Malaysian context, they highlight a critical need for curriculum restructuring to prioritize functional and social communication. Ultimately, this research offers a foundation for developing inclusive, sensory-aware language programs that improve the educational quality of life and social integration for children with ASD.

This intervention-based study contributes original empirical evidence to the field of special education in Malaysia, specifically regarding Arabic as a second language for neurodivergent learners. A key strength lies in its methodological design, which utilizes a controlled experimental approach to validate the efficacy of language games. The study's rigor is further supported by a researcher-developed instrument for which content validity was established through expert judgment and internal consistency was verified, making the findings relevant for educators and policy-makers

seeking evidence-based strategies for inclusive classrooms.

Limitations and Directions for Future Research

Several limitations should be considered when interpreting these findings. First, the sample was small ($N = 17$) and drawn from a single school, which restricts the generalizability of the results. The sample nevertheless comprised the entire population of non-native Arabic-speaking children with ASD enrolled at the school, so no eligible participant was excluded. A sensitivity analysis indicates that a design with nine and eight participants per group can detect an effect of approximately $d = 1.45$ at $\alpha = 0.05$ with 80% power in a two-tailed test; the effects observed here exceeded that threshold by a wide margin, but smaller and potentially more realistic effects would not have been detectable.

Second, outcomes were measured with an instrument developed by the researcher and administered in a structured testing situation. Performance on such an instrument is not equivalent to functional use of Arabic in spontaneous classroom or social interaction and the gains reported here should therefore be read as gains in tested language performance rather than as demonstrated communicative transfer. Third, the same researcher designed the instrument, delivered the intervention and administered the post-test; no blinded assessor was involved and the possibility of experimenter bias cannot be excluded.

Fourth, the participants were verbal in their native language and their ASD severity ranged from mild to moderate, so the findings cannot be extended to minimally verbal or non-speaking children, whose communication profiles differ substantially. Fifth, no follow-up measurement was taken after the two-month intervention, so the durability of the gains is unknown.

Future research should therefore recruit larger and multi-site samples, include children across a wider range of communication profiles, employ blinded outcome assessment together with a validated Arabic language measure, add observational indices of spontaneous language use in natural settings and incorporate delayed post-testing to establish whether the observed gains are maintained over time.

Abbreviations

AFL: Arabic as a Foreign Language, ASD: Autism Spectrum Disorder.

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Author Contributions

All authors contributed equally.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Data Availability

Data supporting the findings of this study are available from the corresponding author upon request.

Declaration of Artificial Intelligence (AI) Assistance

During the preparation of this manuscript the authors used an AI-assisted language tool for two limited purposes: checking the English rendering of passages originally drafted in Arabic and locating candidate references for the literature review. All references retrieved in this way were subsequently read and verified by the authors against the original publications. No AI tool was used to generate, analyze or interpret the study data, to produce any figure or table, or to draft the scientific content of the manuscript. The authors reviewed and edited all text and take full responsibility for the content of the publication.

Ethics Approval

This study was conducted in accordance with the ethical principles for research involving human participants. Formal permission to carry out the research was granted in writing by the administration of Spectrum International School, Kuala Lumpur, on 29 May 2025; the signed and stamped approval letter is available from the

corresponding author on request. Written informed consent was obtained from the parents or legal guardians of all participating children on consent forms endorsed by the school and each child's verbal assent was sought before every session. Participation was voluntary and participants were free to withdraw at any stage without consequence. Confidentiality and anonymity were strictly maintained throughout the research process and no identifying information about any child is reported.

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