VISUAL-SPATIAL INTEGRATED CURRICULUM FOR SPEECH DEVELOPMENT IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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Abstract: This study examines the curriculum and teaching implications derived from the Visual-Spatial Ability Mediated Model of Speech Fluency in Autism Spectrum Disorder (VSA-MSF-ASD) for special education settings in Malaysia. The empirical foundations of this framework were previously established through a cross-sectional quantitative study involving 356 respondents comprising special education teachers and caregivers across Klang Valley and Kuching, Sarawak; the present paper focuses on translating those empirical findings into a practical curriculum design framework with actionable teaching strategies. The original study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) and revealed that visual-spatial abilities function as a central hub influencing both cognitive factors (executive functions, $\beta = 0.656$; prior knowledge, $\beta = 0.794$) and affective factors (self-efficacy, $\beta = 0.796$; attitude, $\beta = 0.728$), with the integrated model explaining 48.7% of variance in speech utterance achievement. Based on these findings, this paper develops a curriculum design framework comprising four integrated domains: visual-semantic knowledge building, visual-executive scaffolding, affective engagement through visual modalities, and systematic speech output facilitation. Practical teaching strategies aligned with each domain are proposed, with implications for curriculum reform in special education programmes in Malaysia and the broader Asia Pacific region. A key limitation is that the proposed framework has not yet been experimentally validated in classroom settings; future intervention studies are needed to assess its practical effectiveness. The study aligns with United Nations Sustainable Development Goal 4 (Quality Education) and Malaysia Education Blueprint 2013–2025.

Keywords: Visual-spatial curriculum, autism spectrum disorder, speech development, special education, inclusive pedagogy.

INTRODUCTION

The education of children with autism spectrum disorder (ASD) represents one of the most pressing challenges in contemporary special education. With prevalence rates continuing to rise globally and within Malaysia specifically, educators are confronted with the urgent need to develop evidence-based curricula that effectively address the communication difficulties central to ASD (American Psychiatric Association, 2013). In Malaysia, the prevalence of ASD among school-age children has increased significantly from 6.34 per 1,000 children in 2018 to 9.29 per 1,000 children in 2022 (Shair et al., 2024), underscoring the growing demand for structured educational interventions. While considerable research has investigated the neurocognitive mechanisms underlying speech development in this population, a persistent gap exists between research findings and their practicality in curriculum design and classroom teaching strategies (Kasari et al., 2012). Specifically, there is a lack of empirically grounded curriculum frameworks that systematically translate visual-spatial processing strengths into structured teaching strategies for speech development in children with ASD. This gap is particularly acute in the Malaysian context, where the Integrated Special Education Programme (Program Pendidikan Khas Integrasi, PPKI) serves as the primary educational provision for children with ASD. Yet, the curriculum frameworks that systematically integrate visual-spatial strategies for speech development remain underdeveloped.

Research has consistently documented that many individuals with ASD demonstrate relative strengths in visual-spatial processing (Grandin, 2009; Mottron et al., 2006). These strengths represent a cognitive asset that can potentially be leveraged to support areas of difficulty, including speech and verbal communication. However, the translation of this understanding into structured curriculum design has been limited by insufficient empirical evidence regarding the specific pathways through which visual-spatial abilities influence speech development. Without such evidence, curriculum designers and teachers lack the theoretical foundation necessary to make informed decisions about how visual-spatial strategies should be integrated into speech development programmes.

The Visual-Spatial Ability Mediated Model of Speech Fluency in ASD (VSA-MSF-ASD), developed through a comprehensive quantitative study involving 356 respondents across Malaysian educational settings (Hassan, 2024), provides the empirical foundation needed to bridge this research-practice gap. The model demonstrates that visual-spatial abilities function as a central hub influencing both cognitive pathways (prior knowledge and executive functions) and affective pathways (self-efficacy and attitude) to speech utterance achievement. Critically, the model reveals that cognitive factors, particularly executive functions ($\beta = 0.575$, $p < 0.001$) and prior knowledge ($\beta = 0.312$, $p = 0.003$), serve as the direct predictors of speech outcomes, while affective factors operate supportively through cognitive mechanisms.

The purpose of this paper is to translate the empirical findings of the VSA-MSF-ASD framework into a structured curriculum design framework with practical teaching strategies for special education settings. By examining the specific pathways identified in the model and deriving corresponding curriculum components, this study addresses a critical need in special education research and practice. The curriculum framework proposed herein is specifically designed for the Malaysian PPKI context but carries implications for special education curriculum design across the Asia Pacific region.

Research Objectives

This study pursues three primary research objectives. First, the research aims to synthesise the empirical findings from the VSA-MSF-ASD framework to identify key evidence-based principles for curriculum design in special education for children with ASD. Second, the study proposes a visual-spatial integrated curriculum design framework that translates these empirical findings into structured curriculum domains and teaching strategies. Third, the research examines the implications of this framework for curriculum reform in Malaysian special education programmes and its alignment with national and international educational goals.

Significance of the Study

This study makes several important contributions. From a theoretical perspective, it bridges the gap between neurocognitive research on ASD and curriculum design theory, demonstrating how empirical findings from structural equation modeling can inform practical educational frameworks. From a practical standpoint, the proposed curriculum framework provides special education teachers with evidence-based guidelines for integrating visual-spatial strategies into their teaching practice. The study also contributes to curriculum development policy in Malaysia by providing an empirically grounded framework that aligns with the Malaysian Education Blueprint 2013–2025 and United Nations Sustainable Development Goal 4 (Quality Education), which emphasises inclusive and equitable quality education for all learners (Ministry of Education Malaysia, 2013; United Nations, 2015).

LITERATURE REVIEW

Curriculum Design in Special Education for ASD

Curriculum design for children with ASD has evolved considerably over the past three decades, moving from predominantly behavioural approaches toward more comprehensive, multi-domain frameworks that recognise the complex interplay of cognitive, affective, and communicative factors in learning (Prizant et al., 2006). The SCERTS Model (Social Communication, Emotional Regulation, and Transactional Support) exemplifies this shift by emphasising the integration of communication goals with emotional and relational supports. Similarly, the Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) programme developed by Mesibov et al. (2005) explicitly incorporates visual structure as an organising principle for learning environments and curriculum delivery. However, a critical comparison reveals that neither model fully addresses the empirical mechanisms linking visual-spatial processing to speech outcomes. The SCERTS Model prioritises

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social-emotional regulation but does not specify how visual-spatial strengths can be systematically harnessed to build cognitive pathways for speech development. The TEACCH programme, while pioneering in its use of structured visual environments, treats visual supports primarily as organisational tools rather than as a foundational curriculum principle grounded in empirically validated cognitive and affective pathways. The VS-ICDF proposed in this study addresses these gaps by grounding each curriculum domain in specific empirical relationships identified through structural equation modelling, thereby providing a more precise evidence-based rationale for visual-spatial integration in speech development curricula.

Despite these advances, a significant gap persists between the theoretical sophistication of curriculum models and the practical realities of classroom implementation, particularly in developing countries within the Asia Pacific region. In Malaysia, the special education curriculum operates within the PPKI framework under the Ministry of Education, which mandates modified mainstream curricula for students with special educational needs. However, teachers frequently report a lack of guidance on how to adapt curricula specifically for children with ASD, particularly regarding the systematic use of visual-spatial strategies for speech development (Hassan et al., 2024b). This gap underscores the need for empirically grounded curriculum design frameworks that provide clear, actionable guidance for teachers.

Visual-Spatial Processing as a Curriculum Foundation

The visual-spatial processing strengths observed in many individuals with ASD have been well documented in the research literature. Grandin (2009) described visual thinking as a fundamental characteristic of autism, while Mottron et al. (2006) proposed the Enhanced Perceptual Functioning model to explain the superior performance of individuals with ASD on visual-spatial tasks. These strengths suggest that curriculum design should leverage visual-spatial modalities as a primary channel for instruction, rather than treating them merely as supplementary supports.

The constructivist perspective on curriculum design provides a useful framework for understanding how visual-spatial strengths can be systematically incorporated into educational programmes. Ausubel (1968) emphasised that the most important factor influencing learning is what the learner already knows, proposing that new knowledge should be connected to existing cognitive structures through advance organisers. For children with ASD, visual advance organisers that draw upon spatial processing strengths may be particularly effective in building the prior knowledge foundations necessary for speech development (Hassan et al., 2024a). The visual-semantic mapping approach, in which abstract linguistic concepts are represented through concrete visual-spatial relationships, aligns with both constructivist learning principles and the processing strengths of children with ASD.

Executive Functions and Curriculum Scaffolding

Executive functions, encompassing working memory, cognitive flexibility, and inhibitory control, play a critical role in speech production and have been identified as the strongest cognitive predictors of speech utterance achievement in children with ASD (Diamond, 2013; Hill, 2004). From a curriculum design perspective, this finding suggests that speech development programmes should explicitly incorporate executive function scaffolding within their instructional design. Dawson and Guare (2018) proposed that executive function skills can be developed through structured environmental supports and graduated practice, principles that are directly applicable to curriculum design.

The integration of visual-spatial strategies with executive function scaffolding represents a promising approach for curriculum design. Visual schedules, graphic organisers, and visual problem-solving tools can simultaneously support executive function development and leverage visual-spatial strengths (Mesibov et al., 2005). When these tools are systematically embedded within a speech development curriculum, they may support the cognitive planning, sequencing, and monitoring processes essential for verbal communication.

Affective Engagement in Curriculum Design

While cognitive factors have been identified as the proximal predictors of speech outcomes, affective factors play an important supportive role in creating conditions favourable for learning. Bandura (1997) demonstrated that self-efficacy beliefs significantly influence engagement and persistence, while Ajzen (2001) established that attitudes shape behavioural intentions. In the context of curriculum design for children with ASD, these affective

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dimensions must be addressed through the learning environment and instructional approach, even if they do not directly predict speech outcomes (Pekrun, 2006).

Hassan et al. (2023) developed the Detective Looking Chart-Plutchik Emotion Games for children with ASD, demonstrating how visual approaches can engage children emotionally through the VARK model (Fleming & Mills, 1992). Such innovations illustrate the potential for curriculum design to address affective engagement through visual-spatial modalities, creating positive emotional associations with communication activities that support sustained participation in speech development programmes.

The VSA-MSF-ASD Framework as Curriculum Foundation

The VSA-MSF-ASD framework provides a comprehensive empirical foundation for curriculum design by identifying the specific pathways through which visual-spatial abilities influence speech development. The framework demonstrates that visual-spatial abilities strongly predict four downstream factors (prior knowledge, executive functions, self-efficacy, and attitude) with large effect sizes across all pathways. Among these, the cognitive factors (executive functions and prior knowledge) directly predict speech utterance achievement, while affective factors operate supportively. The detailed path coefficients and effect sizes are presented in Table 1 of the Results section. These empirical relationships provide clear guidance for curriculum design: interventions should prioritise visual-spatial approaches to building cognitive foundations while simultaneously nurturing affective engagement.

Figure 1 presents the Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF), which illustrates the evidence-based translation of the VSA-MSF-ASD empirical model into a structured curriculum design framework. The upper portion depicts the empirical relationships established through PLS-SEM analysis, with visual-spatial abilities functioning as the central hub predicting both cognitive and affective factors. The lower portion translates these empirical pathways into four interconnected curriculum domains: Domain 1 (Visual-Semantic Knowledge Building), Domain 2 (Visual-Executive Scaffolding), Domain 3 (Affective Engagement Through Visual Modalities), and Domain 4 (Systematic Speech Output Facilitation). The framework distinguishes between significant direct predictors of speech utterance achievement (represented by solid arrows) and non-significant supportive pathways (represented by dashed arrows). Specific path coefficients are detailed in Table 1.

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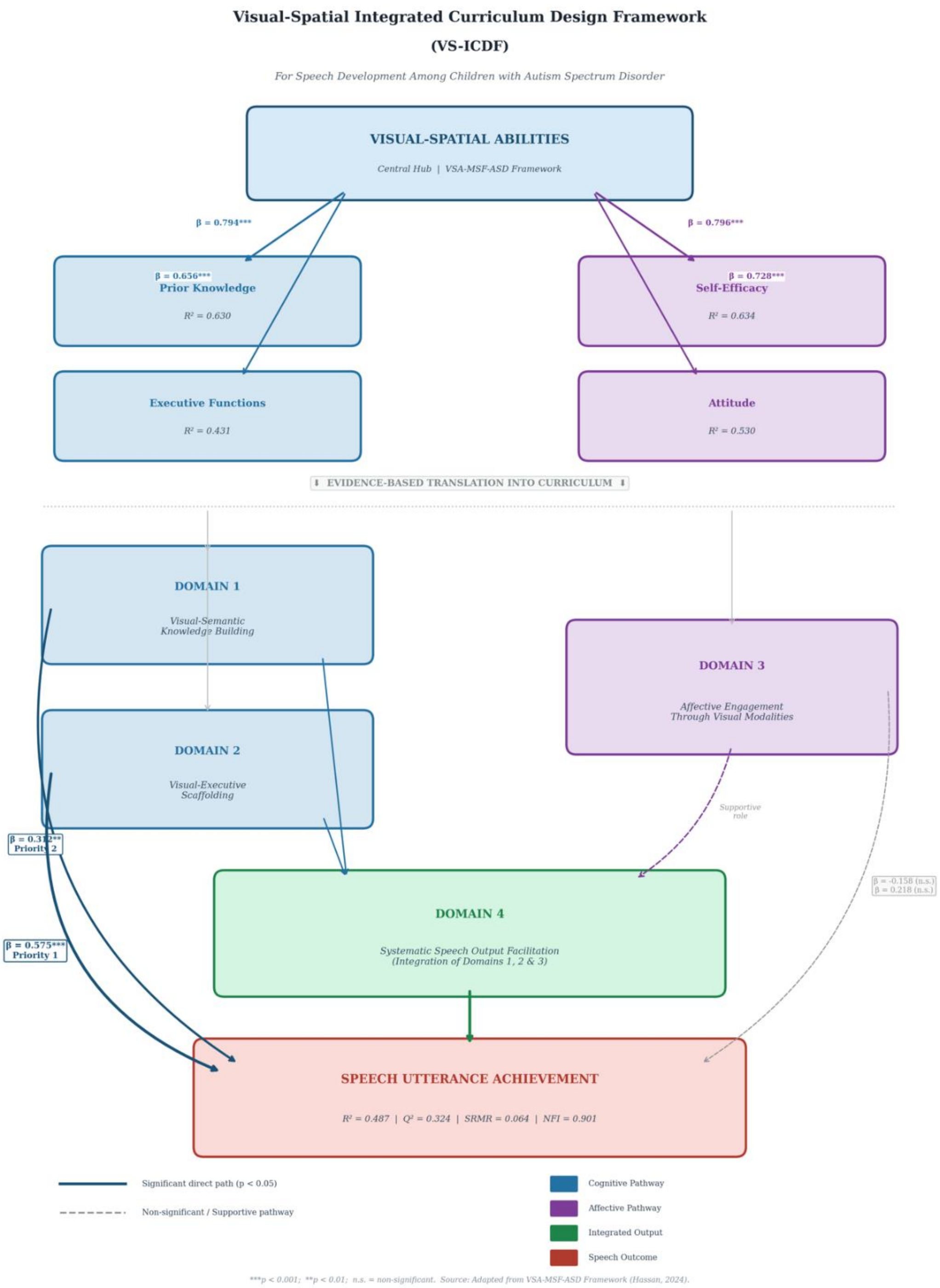
Figure 1.
The Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF) for Speech Development Among Children with Autism Spectrum Disorder



Note. Adapted from the VSA-MSF-ASD Framework (Hassan, 2024). Solid arrows indicate significant paths ($p < 0.05$); dashed arrows indicate non-significant or supportive pathways. ***$p < 0.001$; **$p < 0.01$; n.s. = non-significant.

METHODOLOGY

Research Design

This study employed a two-phase approach. The first phase involved the original empirical investigation using a cross-sectional quantitative design with Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the VSA-MSF-ASD framework. The second phase, which constitutes the primary contribution of this paper, involved a systematic translation of the empirical findings into a curriculum design framework through evidence-based design principles derived from the structural model results. To ensure the validity of this translation process, three procedures were employed: (a) theoretical mapping, whereby each empirical pathway was systematically linked to established curriculum design principles from the literature; (b) alignment with the Understanding by Design (UbD) backward design framework (Wiggins & McTighe, 2005); and (c) cross-referencing of proposed teaching strategies with existing evidence-based practices in ASD education, including the TEACCH and SCERTS models, to ensure coherence with the broader field.

The UbD framework advocates backward design, beginning with desired learning outcomes and working backward to identify assessment evidence and plan learning experiences. This approach was selected because it aligns with the evidence-based orientation of the VSA-MSF-ASD framework, ensuring that curriculum components are directly linked to empirically validated predictors of speech outcomes.

Participants and Data Collection

The empirical foundation for the curriculum framework was derived from data collected from 356 respondents comprising special education teachers (n = 189, 53.1%) and caregivers or parents (n = 167, 46.9%) of children with ASD enrolled in PPKI programmes. The use of teacher and caregiver reports as informants is justified because these respondents have sustained daily interaction with the children and possess professional or experiential knowledge of their developmental trajectories; moreover, direct assessment of children with ASD—particularly those with limited verbal abilities—presents significant methodological challenges that make informant-report a widely accepted alternative in ASD research (Kasari et al., 2012). Respondents were sampled from Klang Valley, Selangor (n = 198, 55.6%) and Kuching, Sarawak (n = 158, 44.4%), representing urban and semi-urban educational contexts respectively. The majority of respondents (60.1%) had more than five years of experience working with children with ASD, ensuring informed assessments of children's abilities and development.

Children's ASD severity levels were distributed across Level 1 (requiring support, 33.1%), Level 2 (requiring substantial support, 43.8%), and Level 3 (requiring very substantial support, 23.1%). This distribution ensures that the curriculum framework is informed by data representing the full spectrum of support needs encountered in PPKI settings.

Analytical Approach

PLS-SEM analysis was conducted using SmartPLS 4.0 with bootstrap resampling (5,000 iterations). The measurement model was assessed through indicator reliability (outer loadings > 0.70), internal consistency (composite reliability > 0.70), convergent validity (AVE > 0.50), and discriminant validity (HTMT < 0.85). The structural model was evaluated through path coefficient significance, coefficient of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and model fit indices (SRMR, NFI).

The curriculum design translation followed a systematic process: (a) identification of significant empirical pathways, (b) derivation of curriculum design principles from each pathway, (c) development of curriculum domains corresponding to the model's constructs, and (d) formulation of practical teaching strategies aligned with each domain.

RESULTS

Empirical Foundations: Key Findings from the VSA-MSF-ASD Model

The measurement model demonstrated satisfactory properties across all criteria. All indicator outer loadings exceeded 0.70. Composite reliability values ranged from 0.87 to 0.94, and AVE values ranged from 0.53 to 0.62. HTMT values between all construct pairs were below 0.85, confirming valid and reliable measurement.

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Table 1 presents the key structural relationships from the VSA-MSF-ASD model that inform curriculum design decisions.

Table 1
Key Empirical Pathways Informing Curriculum Design

Pathway	β	p-value	f^2	R^2	Significance	Curriculum Implication
VSA → Prior Knowledge	0.794	<0.001	1.704	0.630	Yes	Domain 1
VSA → Executive Functions	0.656	<0.001	0.753	0.431	Yes	Domain 2
VSA → Self-Efficacy	0.796	<0.001	1.736	0.634	Yes	Domain 3
VSA → Attitude	0.728	<0.001	1.127	0.530	Yes	Domain 3
EF → Speech Utterance	0.575	<0.001	0.431	—	Yes	Priority 1
PK → Speech Utterance	0.312	0.003	0.062	—	Yes	Priority 2
SE → Speech Utterance	-0.158	0.297	0.009	—	No	Supportive
ATT → Speech Utterance	0.218	0.142	0.018	—	No	Supportive

Note. VSA = Visual-Spatial Abilities; EF = Executive Functions; PK = Prior Knowledge; SE = Self-Efficacy; ATT = Attitude. Full model R^2 for Speech Utterance = 0.487; SRMR = 0.064; NFI = 0.901.

Table 1 reveals several critical findings for curriculum design. First, visual-spatial abilities demonstrate strong predictive relationships with all downstream factors, confirming their role as the central hub for curriculum integration. Second, the cognitive pathway (executive functions and prior knowledge) shows significant direct effects on speech outcomes, establishing these as priority curriculum targets. Third, affective factors, while strongly predicted by visual-spatial abilities, do not directly predict speech outcomes, indicating their supportive rather than primary role in curriculum design.

The Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF)

Based on the empirical findings from the VSA-MSF-ASD model, this study proposes the Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF) comprising four interconnected domains, each corresponding to a validated pathway in the structural model. Table 2 presents the framework domains, their empirical foundations, and associated teaching strategies.

Table 2
The Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF): Domains and Teaching Strategies

Curriculum Domain	Empirical Foundation	Learning Objectives	Teaching Strategies
Domain 1: Visual-Semantic Knowledge Building	VSA → PK (β = 0.794, R^2 = 0.630); PK → Speech (β = 0.312)	Build vocabulary and conceptual understanding through visual-spatial representations	Visual vocabulary cards with spatial organisation; Concept mapping linking images to words; Categorisation tasks using visual sorting; Visual-semantic association charts
Domain 2: Visual-Executive Scaffolding	VSA → EF (β = 0.656, R^2 = 0.431); EF → Speech (β = 0.575)	Develop executive function skills through visual-spatial scaffolding for speech planning	Visual schedules for speech task sequences; Graphic organisers for sentence construction; Visual cue cards for self-monitoring; Colour-coded planning templates for verbal expression
Domain 3: Affective Engagement Through Visual Modalities	VSA → SE (β = 0.796); VSA → ATT (β = 0.728)	Foster positive self-efficacy and attitudes toward communication through visual success experiences	Visual progress tracking charts; Emotion recognition using visual tools; Graduated visual communication tasks for mastery; Visual reward systems reinforcing verbal attempts

Domain 4: Systematic Speech Output Facilitation	Full model $R^2 = 0.487$; EF and PK as direct predictors	Facilitate speech production through integrated visual-cognitive-affective support	Picture Exchange Communication Systems (PECS) progression; Visual story scripts for verbal practice; Structured visual prompting hierarchies; Video modelling with visual scaffolds

Note. Domains are sequenced to reflect the theoretical pathway from foundational processing to speech output. Teaching strategies within each domain are illustrative, not exhaustive.

Domain-Specific Implementation Guidelines

Domain 1: Visual-Semantic Knowledge Building. The empirical finding that visual-spatial abilities explain 63.0% of variance in prior knowledge ($\beta = 0.794$, $p < 0.001$) provides compelling justification for curriculum activities that build vocabulary and conceptual foundations through visual-spatial representations. In practice, teachers should employ visual vocabulary cards organised spatially by semantic categories (e.g., animals, foods, actions), concept maps that visually represent relationships between words and ideas, and categorisation tasks that require children to sort visual stimuli into meaningful groups. These activities leverage the strong relationship between visual-spatial processing and knowledge acquisition identified in the VSA-MSF-ASD model. Ausubel's (1968) advance organiser principle supports this approach, as visual advance organisers can activate existing knowledge structures and provide scaffolding for new vocabulary acquisition.

Domain 2: Visual-Executive Scaffolding. Given that executive functions emerged as the strongest predictor of speech utterance achievement ($\beta = 0.575$, $f^2 = 0.431$), this domain warrants priority in curriculum implementation. The finding that visual-spatial abilities significantly predict executive functions ($\beta = 0.656$, $R^2 = 0.431$) indicates that visual scaffolding can support the development of working memory, cognitive flexibility, and inhibitory control necessary for speech production. Teachers should implement visual schedules that make speech task sequences explicit and predictable, graphic organisers that scaffold sentence planning and construction, and visual self-monitoring tools that support error detection and correction during verbal communication. These strategies align with Dawson and Guare's (2018) recommendation for structured environmental supports to develop executive function skills.

Domain 3: Affective Engagement Through Visual Modalities. Although self-efficacy and attitude did not demonstrate significant direct effects on speech outcomes, they are strongly shaped by visual-spatial abilities ($R^2 = 0.634$ and 0.530, respectively) and play a supportive role in maintaining engagement with learning activities. Curriculum activities in this domain should focus on creating positive emotional associations with communication through visual success experiences. Visual progress tracking charts that make achievement visible, graduated communication tasks designed for mastery at each level, and emotion recognition activities using visual tools (Hassan et al., 2023) can nurture positive self-efficacy and attitudes. These affective supports create the motivational conditions under which cognitive engagement, the proximal predictor of speech outcomes, can flourish.

Domain 4: Systematic Speech Output Facilitation. The final domain integrates the preceding three domains into structured speech production activities. Drawing upon the full model's explanatory power ($R^2 = 0.487$), this domain employs comprehensive visual support to facilitate actual verbal output. Teaching strategies include PECS progression from picture exchange to verbal accompaniment (Hassan et al., 2024a), visual story scripts that provide structured opportunities for verbal practice, prompting hierarchies that systematically fade visual supports as speech competence develops, and video modelling that combines visual demonstration with verbal targets. This domain represents the convergence of all curriculum components toward the outcome of speech utterance achievement.

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Table 3
Implementation Priority Matrix by ASD Severity Level

Curriculum Domain	Level 1 (Requiring Support)	Level 2 (Substantial Support)	Level 3 (Very Substantial Support)
Domain 1: Visual-Semantic Knowledge Building	Moderate emphasis; extend to abstract concepts	High emphasis; concrete visual-word associations	Highest emphasis; foundational object-label pairing
Domain 2: Visual-Executive Scaffolding	Moderate; develop complex planning skills	High; structured visual sequences for speech tasks	High; basic visual routines and simple sequencing
Domain 3: Affective Engagement	Moderate; build communication confidence	High; reduce communication anxiety through visual success	High; establish positive associations with verbal attempts
Domain 4: Speech Output Facilitation	High; complex verbal expression with fading supports	High; structured verbal practice with visual scripts	Moderate; initial focus on single-word utterances

Note. Priority levels reflect the empirical finding that children across all severity levels benefit from visual-spatial approaches, with differentiated emphasis based on developmental needs. The sample distribution of 33.1% Level 1, 43.8% Level 2, and 23.1% Level 3 ensures relevance across the spectrum.

DISCUSSION

Translating Empirical Evidence into Curriculum Practice

The Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF) proposed in this study represents a systematic attempt to bridge the persistent gap between neurocognitive research on ASD and classroom teaching practice. By grounding each curriculum domain in specific empirical pathways identified through PLS-SEM analysis, the framework ensures that teaching strategies are directly linked to validated predictors of speech outcomes rather than based solely on intuition or tradition. This evidence-based approach to curriculum design aligns with contemporary calls for research-informed educational practice (Creswell & Creswell, 2018) and responds to the specific needs of special education teachers in Malaysian PPKI programmes who require clear, actionable guidance.

The finding that visual-spatial abilities function as a central hub connecting both cognitive and affective pathways has profound implications for curriculum architecture. Rather than treating visual supports as supplementary aids, the VS-ICDF positions visual-spatial strategies as the foundational principle underlying all curriculum domains. This represents a notable conceptual advancement from conventional approaches that may use visual supports incidentally, moving toward a systematic framework in which visual-spatial integration permeates curriculum design, instructional delivery, and assessment. The TEACCH programme's emphasis on structured visual environments (Mesibov et al., 2005) provides precedent for this approach, but the VS-ICDF extends it by specifying the cognitive and affective mechanisms through which visual strategies influence speech outcomes.

Priority of Cognitive Pathways in Curriculum Design

A key curriculum design principle emerging from this study is the prioritisation of cognitive pathways, particularly executive functions, as direct targets for speech development. The finding that executive functions represent the strongest predictor of speech utterance achievement ($\beta = 0.575$, $f^2 = 0.431$) suggests that curriculum time and resources allocated to executive function scaffolding through visual-spatial modalities will yield the most direct impact on speech outcomes. This finding is consistent with Diamond's (2013) assertion that executive functions are fundamental to complex cognitive performance and extends it to the specific domain of speech development in ASD.

The implications for classroom practice are significant. Teachers working within the PPKI framework should be trained to recognise that activities supporting working memory (e.g., visual sequencing tasks), cognitive flexibility (e.g., visual sorting by multiple criteria), and inhibitory control (e.g., visual cue-response inhibition tasks) are not merely cognitive exercises but are directly building the cognitive foundations for speech production. This

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understanding can transform how teachers perceive and prioritise various instructional activities, moving beyond a narrow focus on speech drills to a broader cognitive scaffolding approach that addresses the underlying predictors of verbal communication.

The Supportive Role of Affective Curriculum Components

The VS-ICDF's treatment of affective engagement as a supportive rather than primary curriculum domain reflects the empirical finding that self-efficacy and attitude do not directly predict speech outcomes when cognitive factors are controlled. However, this should not be interpreted as diminishing the importance of affective components. The strong relationships between visual-spatial abilities and affective factors ($R^2 = 0.634$ for self-efficacy; $R^2 = 0.530$ for attitude) indicate that visual-spatial experiences profoundly shape children's confidence and emotional orientations toward communication. These affective conditions may enable the cognitive engagement that ultimately drives speech development, consistent with Linnenbrink and Pintrich's (2002) model of motivation as an enabler of academic success.

For curriculum designers, this finding suggests that affective engagement should be woven throughout all curriculum domains rather than addressed in isolation. Each instructional activity, regardless of its primary cognitive target, should be designed to generate positive affective experiences through appropriate challenge levels, visual feedback on progress, and celebration of communicative attempts. Hassan et al. (2024b) emphasised the importance of building inclusive communities that support families with autistic children, and the curriculum should reflect this inclusive orientation by fostering positive communication environments both within and beyond the classroom.

Implications for Special Education Curriculum Reform in Malaysia

The VS-ICDF carries significant implications for curriculum reform within the Malaysian special education system. The Malaysian Education Blueprint 2013–2025 articulates a commitment to inclusive education and quality educational outcomes for all students, including those with special educational needs (Ministry of Education Malaysia, 2013). However, the operationalisation of this commitment in terms of specific curriculum frameworks for children with ASD has been limited. The VS-ICDF provides an empirically grounded framework that can inform policy-level curriculum design decisions.

The framework's applicability across both urban (Klang Valley) and semi-urban (Kuching, Sarawak) settings, as reflected in the study's sampling design, enhances its relevance for national implementation. The representation of East Malaysian perspectives is particularly important given that special education resources and teacher training opportunities may differ between Peninsular Malaysia and Sabah and Sarawak. The VS-ICDF's emphasis on visual-spatial strategies, which can be implemented with readily available materials, may be especially valuable in resource-limited settings.

Limitations and Future Directions

Several limitations warrant acknowledgement. First, the curriculum framework is derived from cross-sectional data, which cannot establish causal relationships. Longitudinal intervention studies testing the effectiveness of the VS-ICDF in improving speech outcomes are needed to validate the framework's practical impact. Second, the framework has not yet been empirically tested in classroom settings, and implementation fidelity, teacher perceptions, and student outcomes should be examined through future experimental or quasi-experimental research designs.

Third, the reliance on teacher and caregiver report data, while appropriate for the initial model development, may not fully capture the nuances of children's internal cognitive and affective processes. Future research could incorporate direct observation, child assessment, and physiological measures to provide complementary evidence. Fourth, the framework should be refined through participatory action research involving special education teachers, speech-language pathologists, and families, ensuring that practical constraints and contextual factors are addressed in curriculum implementation. These limitations notwithstanding, the study carries several practical implications: (a) teacher training programmes within PPKI settings should incorporate explicit instruction on visual-spatial scaffolding techniques for speech development; (b) curriculum policy at the national level could integrate visual-spatial principles as a structured component of special education standards for children with ASD; (c) the VS-ICDF provides a replicable framework that researchers in other Asia Pacific contexts may adapt and validate for their local educational systems; and (d) interdisciplinary collaboration between curriculum designers, speech-language pathologists, and occupational therapists should be encouraged to ensure holistic implementation of the framework.

CONCLUSION

This study translates the empirical findings of the VSA-MSF-ASD framework into a practical curriculum design framework for speech development among children with ASD in Malaysian special education settings. The Visual-Spatial Integrated Curriculum Design Framework (VS-ICDF) comprises four interconnected domains: visual-semantic knowledge building, visual-executive scaffolding, affective engagement through visual modalities, and systematic speech output facilitation. Each domain is grounded in specific empirical pathways validated through PLS-SEM analysis of data from 356 respondents across Malaysian educational contexts.

The framework's central contribution lies in establishing visual-spatial integration as the foundational principle for curriculum design, with cognitive pathway prioritisation as the primary strategy for improving speech outcomes. The prioritisation of executive function scaffolding, as the strongest predictor of speech achievement, represents a significant curriculum design insight that challenges approaches focused solely on direct speech practice. Simultaneously, the framework recognises the supportive role of affective engagement in sustaining the cognitive effort necessary for speech development.

The VS-ICDF provides special education teachers with evidence-based guidance for integrating visual-spatial strategies into their teaching practice, addressing a persistent need in Malaysian PPKI programmes and the broader Asia Pacific region. By aligning with the Malaysian Education Blueprint 2013–2025 and United Nations Sustainable Development Goal 4, the framework has the potential to support national and international commitments to inclusive, equitable, and quality education for children with special educational needs, pending empirical validation. Future research should focus on testing the framework through intervention studies in classroom settings, examining both implementation processes and student speech development outcomes, before policy-level adoption can be recommended with confidence.

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REFERENCES

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*(1), 27–58.
American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.
Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. Holt, Rinehart and Winston.
Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.
Dawson, P., & Guare, R. (2018*). Executive skills in children and adolescents: A practical guide to assessment and intervention* (3rd ed.). Guilford Press.
Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168.
Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy*, *11*, 137–155.
Grandin, T. (2009). *Thinking in pictures: My life with autism* (Expanded ed.). Vintage Books.
Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). SAGE.

Hassan, M. H. (2024). *Visual-spatial abilities as mediators of speech fluency in children with Autism Spectrum Disorder* [Unpublished doctoral dissertation]. Universiti Teknologi MARA. https://ir.uitm.edu.my

Hassan, M. H., Ahmad, M. F., Wardi, R. H., Abdullah, M. H., Isa, B., Safwan, N. S. Z., & Yusoff, S. M. (2024a). The influence of Picture Exchange Communication Systems (PECS) on the affective development of speech utterances in Autism Spectrum Disorder (ASD). *Journal of Contemporary Health Research*, *14*(2), Article 4088.

Hassan, M. H., Wardi, R. H., Silah, S. B., Abdullah, M. H. H., Michael, V. A., Isa, B., & Ahmad, M. F. (2024b). Building inclusive communities: Examining expert perspectives on support systems for families with autistic children in Malaysia. *Malaysian Journal of Social Sciences and Humanities*, *9*(11), e003097.

Hassan, M. H., Wardi, R. H., Razali, N. M., Hishamuddin, N. A. A., Ahmad, M. F., Nashir, R. M., & Nasir, M. (2023). Help ASD's with fun way: Detective Looking Chart-Plutchik Emotion Games for kids through VARK model to ASD children. *Malaysian Journal of Invention and Innovation*, *2*(1), 56–64.

Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, *8*(1), 26–32.

Kasari, C., Brady, N., Lord, C., & Tager-Flusberg, H. (2012). Assessing the minimally verbal school-aged child with autism spectrum disorder. *Autism Research*, *6*(6), 479–493.

Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School Psychology Review*, *31*(3), 313–327.

Mesibov, G. B., Shea, V., & Schopler, E. (2005). *The TEACCH approach to autism spectrum disorders*. Springer.

Ministry of Education Malaysia. (2013). *Malaysia Education Blueprint 2013–2025*. Ministry of Education.

Mottron, L., Dawson, M., Soulières, I., Hubert, B., & Burack, J. (2006). Enhanced perceptual functioning in autism: An update, and eight principles of autistic perception. *Journal of Autism and Developmental Disorders*, *36*(1), 27–43.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, *18*(4), 315–341.

Prizant, B. M., Wetherby, A. M., Rubin, E., Laurent, A. C., & Rydell, P. J. (2006). *The SCERTS Model: A comprehensive educational approach for children with autism spectrum disorders*. Paul H. Brookes Publishing.

Shair, S. N., Zaki, N. R., Mohd, M. A., Mohd Amin, M. N., Zainan Abidin, A. W., Ahmad, S., & Jamil, N. (2024). Prevalence of Autism Spectrum Disorder among school-age children in Malaysia: Analysis by age and states. *Malaysian Journal of Public Health Medicine, 24*(3), 71–80.

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders* (3rd ed., pp. 335–364). Wiley.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development.* United Nations.

Wiggins, G., & McTighe, J. (2005). *Understanding by Design* (2nd ed.). Association for Supervision and Curriculum Development.

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