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A FUZZY DELPHI APPROACH TO EVALUATING LANGUAGE CURRICULUM MODELS FOR DYSLEXIA

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ABSTRACT

Purpose – The learning challenges faced by dyslexic students highlight the need for curriculum models that go beyond general teaching practices. This study evaluates a newly developed Dyslexia Curriculum Model (DCM) comprising six clusters: Individual Education Plan (IEP), multisensory learning style, teaching method, type of dyslexia, language skills, and assistive technology. The evaluation aims to confirm the model's appropriateness and usability in guiding teachers for language instruction among dyslexic learners.

Methodology – The study employed the Fuzzy Delphi Method (FDM) to obtain expert consensus on eighteen elements within the DCM. Thirty special education experts from different regions of Malaysia participated in the evaluation using a seven-point Likert scale. The process involved fuzzy analysis to determine the threshold values, consensus levels, and defuzzification scores for each element.

Findings – Results show unanimous agreement among experts on all elements, particularly those under the Individual Education Plan cluster, which recorded full consensus. The analysis confirmed that all components met the acceptance criteria, with threshold values below $d \leq 0.2$. These findings indicate that the DCM is both valid and practical for classroom application, offering a clear framework for planning and implementing lessons tailored to dyslexic learners.

Significance – The validated DCM provides a structured yet flexible guide for teachers, combining evidence-based strategies with inclusive approaches. While it was designed for Bahasa Melayu instruction, its adaptable structure allows for use across other language contexts. The study reinforces the importance of expert-driven evaluation in developing inclusive curriculum frameworks and suggests that further research should focus on large-scale implementation and teacher training.

Keyword: Dyslexia, fuzzy Delphi method, curriculum, multi-sensory, language teaching.

INTRODUCTION

The Fourth Industrial Revolution unveils nine key pillars that must be urgently harnessed to transform education. Yet amid this race toward innovation, students with learning difficulties — particularly those with dyslexia — risk being pushed even further to the margins. Despite widespread recognition of their needs, specific teaching and learning models tailored for dyslexic students remain scarce, highlighting a critical gap in the development of school curricula that must be addressed.

Prior research indicates that instructional practices are fragmented, with limited integration of digital competencies, cognitive scaffolding, and inclusive pedagogy. Findings from previous studies indicate that current instructional practices are fragmented, with limited integration of digital competencies, cognitive scaffolding, and inclusive pedagogy (Manson & O'Sullivan, 2021; McLain, 2021; Shaik, 2021; Yanez, et al, 2019). The DCM was developed to address by offering a structured and adaptive framework for curriculum design to support the unique learning profiles of dyslexic students within a context of growing demands for technological literacy, critical thinking, and social skills. The bigger study worked on the premise that, without intentional innovation, educational reforms risk excluding those who need support the most.

This paper reports the evaluation phase of a Dyslexia Curriculum Model (DCM), a specialized curriculum framework developed from a bigger study. This curriculum model is timely to ensure that students with dyslexia are not merely accommodated, but empowered to thrive in this digital age by mastering the basic by mastering the basic 3Rs (reading, writing, and arithmetic). The DCM is not just a model; it is a call to reimagine education through an inclusive, future-ready lens where every learner, regardless of their dyslexia and related learning challenges, can succeed.

The main objective of this study is to evaluate the usability of the developed DCM based on expert consensus. Specifically, the study aims to assess the appropriateness of the sequence of eighteen model elements proposed in the model, as well as to evaluate the suitability of each element according to the classifications outlined within the Dyslexia Curriculum Development Model.

LITERATURE REVIEW

It is widely acknowledged that curriculum development is a vital area of focus in mainstream and special education. Despite being labelled as a straightforward and linear process, in actuality it is robust and is an

amalgamation of different beliefs and ideas. In conventional education, established models like Tyler's Objectives Model (1949) continue to be regarded by many as the benchmark methodology. Nonetheless, it represents more of a system orientated toward efficiency as opposed to meaningful learning. Tyler's emphasis on clear objectives makes curriculum appear more like a checklist rather than a profound learning experience.

In comparison, Taba (1962) offered a teacher-driven approach that was seen as unorthodox at the time. Although she agreed with Tyler that learning should be based on objectives, Taba maintained teachers should begin with students' needs and develop the curriculum from the ground up. She saw teachers as curriculum designers and not mere followers of policy. As such, they have greater ability and autonomy to shape learning in the classroom.

Several other approaches like Wheeler (1967) and Kerr (1968) attempted to add additional flexibility through a cyclical process which provided more adaptability. However, these models continued to consider curriculum as a rigid framework with various elements to be accounted for, rather than an ongoing process. Subsequently, Skilbeck's Situational Model (1984) introduced a novel idea by emphasizing the importance of local context. It motivated schools to design a curriculum that take into account their respective backgrounds and environments. However, this model is still not commonly practiced, particularly in systems that persist on relying heavily on standardization and top-down rules.

In recent years, Wiggins and McTighe's Backward Design (2005) presented the concept of beginning with the end goals before developing lessons. This particular design has earned the approval of many for establishing clarity in curriculum planning. In practice, however, teachers may have to face additional challenges because they would be expected to plan every detail in reverse order with exceptional degrees of creativity, assessment knowledge and strategic thinking. As a result, in schools where teachers are already overworked, this paradigm may not be the magical solution it is often portrayed to be. The model may end up placing additional burden on teachers, instead of promoting clarity and simplifying processes.

There is a dire need for a carefully designed curriculum in the field of special education. This is especially true when there are learners with special learning needs involved. Hence, a number of prominent models were introduced between the 1970s and the beginning of the 2000s. Among them was Bronfenbrenner's Ecological Systems Theory (1979), which enabled educators to view students not as isolated individuals but as persons embedded within multiple interacting systems, including family, school, and society. This particular model provided a more robust approach to understanding student needs. Despite its strengths and depth, it was regarded as being overly difficult to be implemented in actual classrooms (Hassan, 2023). As a consequence, Bronfenbrenner's ideas were often abandoned as schools turned their focus on obtaining swift and measurable results (Crawford, 2020).

Around the same time, Tomlinson (2001) introduced the Differentiated Instruction Model, which encouraged teachers to respond to students' diverse needs, interests, and learning styles. The model gained strong support and was praised for promoting more personalized learning (Liyu & Cheong, 2022). Yet, many teachers found it challenging to apply, especially in large or mixed-ability classrooms with limited support (Hendel, 2021; Plucker & Callahan, 2021). The expectation to constantly adjust lessons can become overwhelming. While the model promotes inclusive and responsive teaching, it also requires a level of

creativity, planning, and time that many teachers simply do not have (Liyu & Cheong, 2022). Still, the model remains relevant, and when supported well, it can help reduce gaps in student learning.

It is strongly recommended that students who possess unique learning styles and learning pace be provided with responsive and flexible instruction. According to Tomlinson (2001), differentiated learning includes tailoring content, process and final output to meet students' needs. Brodersen and Melluzzo (2017) believe that such methods improve students' performance in programs like READ 180 and Cognitive Tutor Algebra I. Furthermore, Komang et al. (2021) posit that differentiation promotes equity by addressing learner diversity. For instance, the Dyslexia Curriculum Model (DCM) adopts this approach to promote inclusive and successful literacy development.

In recent times, a progressive approach in addressing accessibility in education called the Universal Design for Learning (Edyburn, 2010; Rao et al., 2020a, 2020b) is becoming increasingly popular. UDL encourages adaptable teaching methods and various ways for students to obtain information, share what they have learned and maintain engagement. This approach shares several foundations with differentiated instruction, yet adopts a more comprehensive conception of equity. Unfortunately, it is still not widely used in actual classrooms and in certain instances, UDL has become rather superficial perhaps because although teachers are urged to be inclusive, they are not provided with the necessary training or resources. Nonetheless, UDL is a promising concept with the potential to revolutionise classroom practice, particularly when it is accompanied by substantive systemic changes rather than relying solely on individual teacher effort.

In the context of dyslexia, the Orton-Gillingham approach (Ali, 2023; Valde, 2024a, 2024b) which has often been referred to as a compensatory curriculum model, is another model that ought to be discussed in depth. It is well-known for its multi-sensory, structured and phonics-based methods. This approach put emphasis on assisting students decode and recognize language patterns via sight, sound and touch. Coincidentally, such an approach is supported by various research and has been widely employed by intervention programs. The forte of the Orton-Gillingham approach is its methodical and explicit training, specifically for students who find it difficult to grasp foundational literacy.

Notwithstanding its established efficacy, the Orton-Gillingham approach possesses several limitations. Among them is that it necessitates qualified teachers, more teaching time and intensive one-on-one sessions (Christy Austin, 2023; Valde, 2024a). These are resources that may not be readily available nor can they be supplied by schools on a steady basis. As a consequence, implementing the entirety of the Orton-Gillingham program may be difficult as teachers would be expected to simultaneously manage large classes and deliver the required curriculum content. On top of that, the Orton-Gillingham approach poses the risk of over-reliance on remedial measures that focuses on deficits, rather than adjusting the broader learning environment to be more inclusive from the get-go (Ali, 2023; Valde, 2024a). Yet, once combined with inclusive classroom strategies like UDL or differentiated instruction, the Orton-Gillingham approach can be a potent tool for improving reading related literacy among students with dyslexia.

Collectively, the models mentioned have advanced the narrative of inclusive education and it is best to keep in mind that a one-size-fits-all approaches are not favored. Besides, there is the danger of good models becoming burdens instead of bringing about positive improvement, especially when these models are implemented without sufficient support. Therefore, a redesigned strategy from a novel perspective is

required. This new strategy ought to integrate the various elements of curriculum design to produce a wholesome curriculum model for dyslexic language instruction. In essence, a model is merely an instrument that can be leveraged to create a more steadfast commitment among teachers.

The dyslexia curriculum model should function as a pedagogical framework that ensures not only effective content delivery, but also accessible, contextually appropriate learning experiences for students with special needs. Evaluating its effectiveness requires a holistic lens. Nordin et al. (2016) demonstrated that inquiry-based learning enhances achievement in TIMSS, a strategy adaptable to dyslexic learners. Tan et al. (2020) further affirmed the value of inquiry and flipped classroom strategies in deepening conceptual understanding. Therefore, a dyslexia curriculum must adopt teaching approaches that are reflective, adaptive, and continuously improved to suit learners' profiles.

Additionally, usability and cultural relevance are vital elements of an effective and wholesome curriculum. Gooch et al. (2016) believe that gamification greatly enhances motivation in language learning, emphasizing the essential role of technology in special education. Similarly, Supriyadi et al. (2024) suggest that techniques that are infused with culture such as ethnomathematics in Sundanese gamelan modules, boost student's engagement during learning. As such, a dyslexia curriculum should aspire to be inclusive, contextually relevant, and culturally grounded to suit the distinct needs of students.

Curriculum Models for Language Education

Curriculum models in language education have evolved significantly, pivoting away from rigid tendencies and towards more student-centered and communicative methods. For instance, the Communicative Language Teaching (CLT) model (Hymes, 1972; Canale & Swain, 1980), one of the most commonly acknowledged communicative methods, emphasizes real-world language use and communication competence. Although its focus on interaction and communication competence has transformed how language is taught around the world, critics have highlighted its unclear guidelines for grammar teaching and assessment, particularly in exam-focused systems. In simple terms, for teachers who must prioritise linguistic accuracy and syllabus coverage, CLT may create tension between theory and classroom practice.

Another influential approach is the Natural Approach (Krahnke et al., 1985), which promotes language acquisition through meaningful input in a low-stress environment. The idea that learners should first "understand" before being pushed to produce has intuitive appeal. However, in high-stakes schooling systems, this emphasis on delayed output may be misunderstood or even rejected, as teachers are under pressure to produce visible results within limited time frames. Similarly, Task-Based Language Teaching (TBLT) (Ellis, 2003) positions language as a tool to complete real-world tasks, encouraging meaningful use rather than rote learning. Yet, its open-ended nature demands considerable teacher creativity and student autonomy—luxuries that not all classrooms can afford.

In addition, there are bold attempts to integrate content and language skills by models such as the Content and Language Integrated Learning (CLIL) (Do Coyle, 2009). Despite offering bilingual education, it is frequently implemented improperly, particularly when teachers lack content and language expertise. On the other hand, the Lexical Approach focuses on the teaching of language collocations (Lewis, 1993), parts and provides an alternative to grammar-focused interactions. Even so, it does not provide a solid pedagogical structure, rendering many teachers confused about how to design lessons concerning lexical terms.

Bahasa Melayu Curriculum Models: Cultural and Structural Considerations

While this paper emphasizes the teaching of Bahasa Melayu, the broader discussion is relevant to language teaching in general. When it comes to Bahasa Melayu, several curriculum concepts and techniques have been developed to accommodate Malaysia's distinct sociolinguistic setting. For example, the Malaysian Ministry of Education developed the Kurikulum Standard Sekolah Rendah (KSSR) Bahasa Melayu. It takes a modular approach and covers key language components and skills, including listening and speaking, reading, writing, grammar, and literature. This curriculum is an attempt to incorporate 21st-century learning skills and values. However, as with many national curricula, the disparity between the written and implemented curriculum remains significant. As a result, teachers inevitably struggle to strike a balance between finishing the syllabus and the development of higher-order thinking and communication skills, particularly in exam-focused settings.

The KSSR's predecessor, the Pendekatan Bersepadu (Awang Sariyan, 2004), tried to weave together language, values, and national identity via thematic instruction. Despite being in line with the cultural aims of national education, it has been called out for not having enough flexibility and being excessively utopian for classrooms with various student backgrounds as well as abilities. Therefore, in an effort to make language learning authentic and culturally significant, more recent methods like the Model Kurikulum Kontekstual Bahasa Melayu (Yunus & Choo, 2010) have been developed. This paradigm is consistent with worldwide trends moving towards contextual learning, but its efficacy is strongly dependent on teacher creativity and community-centered content development, both of which necessitate a high degree of professional development and local autonomy.

The review suggests that the language curriculum model has undergone few changes over the past decades, as exemplified in the case of the Bahasa Melayu curriculum. The growing awareness of learner diversity, context, and culture demand that teachers implement complex pedagogical models often without adequate time, training, or materials. The key issue is not merely on the model's strength, but whether it can be realistically enacted in everyday classroom practice. Without that, even the most thoughtful curriculum design risks becoming symbolic rather than transformative.

Overview and Interpretation of the Dyslexic Curriculum

In order to have a more comprehensive understanding of the discussion related to this matter, it is important to clarify how the model developed in the actual study should be interpreted, although the focal point of the present study is evaluation. The model serves as a curriculum framework that may be leveraged to guide stakeholders (teachers, curriculum developer, training providers) in selecting relevant curriculum elements or components. Figure 1 shows the DCM which comprises of 18 elements that can be categorized into six major clusters namely, individual education plan, multisensory learning style, teaching method, type of dyslexic, language skills and assistive technology. Figure 1 also illustrates the details of each element based on the larger study's findings.

Figure 1

Interpretive Structural Modeling (ISM) based of the Dyslexia Curriculum Model
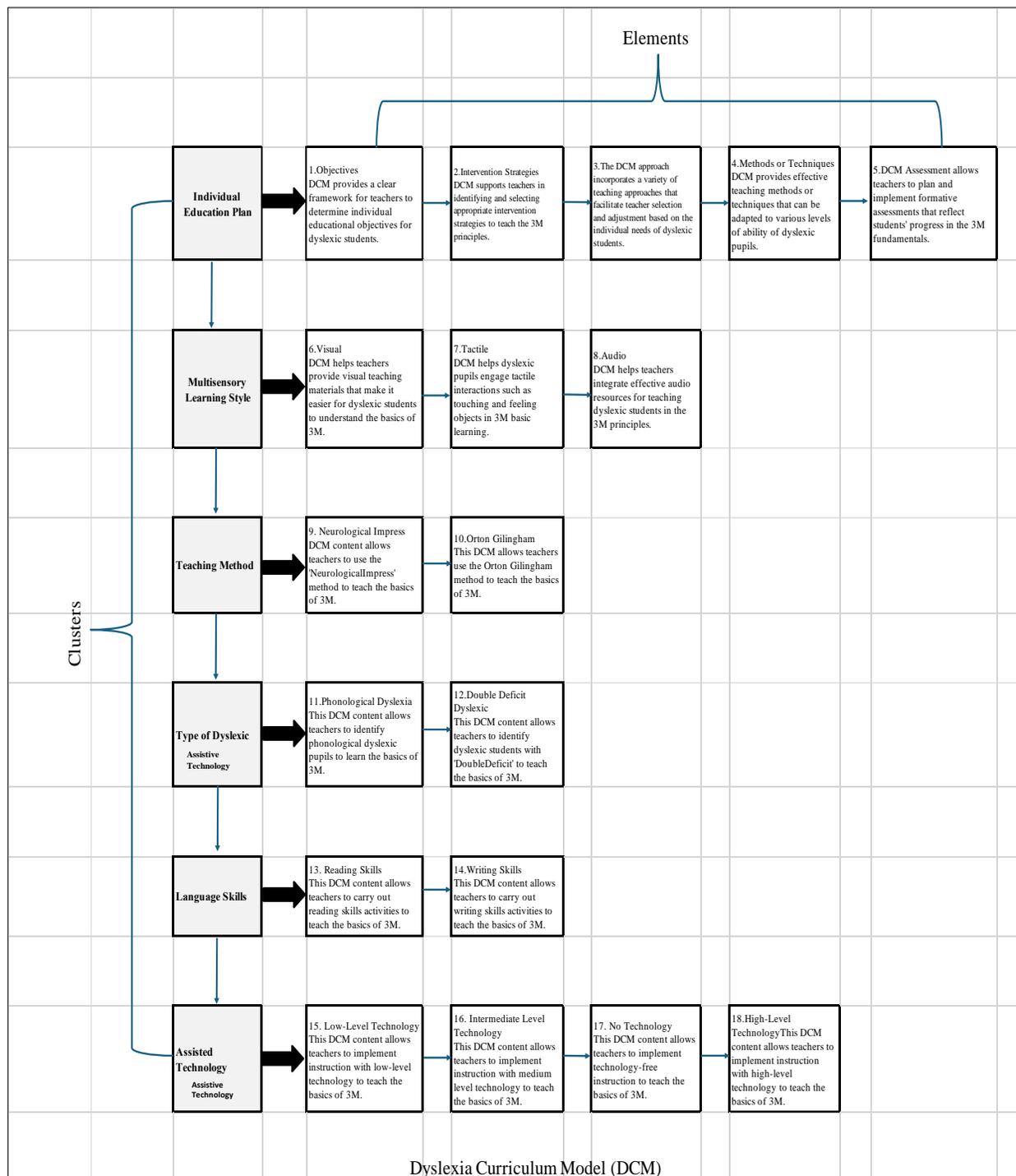
Based on the model in Figure 1, these elements allow teachers or curriculum developers to design their teaching using pick and match method for easy modification with their class' needs. DCM has been divided

into six main clusters namely individual learning plan, multisensory learning style, teaching method, type of dyslexia, language skills and assistive technology. An Individual education plan consists of five main elements that include objectives, intervention strategies, approaches, techniques, and assessments. Individual education plan serves as a structured guide tailored to the needs of students with special needs.

The Dyslexia Curriculum Model (DCM) is divided into six categories: invidual learning plans, multisensory strategies, instructional methods, dyslexia types, language skills, and assistive technologies. On the other hand, the Individual Education Planning (IEP) facilitates targeted interventions via defined goals, strategies, and assessments, focusing on providing inclusive and early support involving teachers, parents, and professionals. These interventions may include multisensory learning that combines visual, auditory and tactile components that are imperative in enhancing the language processing capabilities and memory of Based on the model in Figure 1, these elements allow teachers or curriculum developers to design their teaching using pick and match method for easy modification with their class' needs. DCM has been divided into six main clusters namely individual learning plan, multisensory learning style, teaching method, type of dyslexia, language skills and assistive technology. An Individual education plan consists of five main elements that include objectives, intervention strategies, approaches, techniques, and assessments. Individual education plan serves as a structured guide tailored to the needs of students with special needs, dyslexic learners. Be that as it may, effective instruction must still actively engage multiple senses to promote neural connections and practical knowledge transfer.

It is found that this method could substantially boost dyslexic students' phonological awareness and reading comprehension. Furthermore, the model is able to differentiate between phonological dyslexia (difficulty processing phonemes) and double deficit dyslexia (weakness in both phonological skills and rapid automatized naming), both of which require individualized interventions.

As far as language skills are concerned, it can be surmised that they can be categorized into reading (letter recognition, phonics, comprehension) and writing (spelling, sentence construction), which are interdependent for achieving mastery of literacy. Finally, assistive technology is classified into four levels: low-tech (e.g., flashcards), mid-tech (e.g., voice recorders), high-tech (e.g., educational software), and non-tech (traditional techniques), which provide various alternatives to intervention, based on the learners' unique needs.

At present, advocates are calling for more personalized and tailored learning for dyslexics, which will help students obtain a certain degree of mastery in communicating effectively. Although this paper began with identifying reading weaknesses in mind, current research has suggested that more attention should be given to advanced technologies, including mobile game-based assessments and artificial intelligence (AI), for early detection and intervention. This trend can be seen in the study by Zingoni et al. (2021), which demonstrated efficacy of virtual reality and AI in assisting dyslexic students at tertiary level. These advances in technology not only serve as diagnostic tools, but also improve academic achievement by providing students of all ages with interactive learning platforms.

METHODOLOGY

The Fuzzy Delphi Method (FDM) is an established decision-making tool, which is renowned for its systematic iterative procedure involving experts' opinions and consensus a feature that justifies its adaptation in this study. This study aims to make decision whether an element should be accepted, eliminated or revised based on experts' consensus. As a result of the defuzzification of experts' opinions, each element can be accepted or rejected in a single round of expert assessment, thereby saving time (Abdullah & Siraj, 2018; Jamil et al., 2023; Siraj, 2018; Wang et al., 2019). In the event that experts suggest modifications, FDM allows iterative refinement. The flexibility and systematic nature of FDM provide a substantive balance between expert judgement and methodological rigour. Particularly in education, many studies have adopted FDM to evaluate teaching effectiveness (Chanthiran et al., 2023; Ciptono et al., 2019; H. Zaharah, M. Ridhuan, & M. Jamil, 2014).

A pilot study was conducted on 30 teachers from several schools with special education classes in the northern region of the country. This step was considered necessary to refine the questionnaire items. These teachers were not included in the actual needs analysis study. The instrument presented in Table 1 was subsequently validated by three experts in curriculum, special education, and educational technology.

Table 1

Pilot Study of Evaluation Questionnaire

1	Objectives DPM provides a clear framework for teachers to determine individual educational objectives for dyslexic students.
2	Intervention Strategies DPM supports teachers in identifying and selecting appropriate intervention strategies to teach the 3M principles.
3	The DPM approach incorporates a variety of teaching approaches that facilitate teacher selection and adjustment based on the individual needs of dyslexic students.
4	Methods or Techniques DPM provides effective teaching methods or techniques that can be adapted to various levels of ability of dyslexic pupils.
5	DPM Assessment allows teachers to plan and implement formative assessments that reflect students' progress in the 3M fundamentals.
6	Visual DPM helps teachers provide visual teaching materials that make it easier for dyslexic students to understand the basics of 3M.
7	Kinesthetic DPM helps dyslexic pupils engage in kinesthetic movements or activities as one of the basic learning of 3M.
8	Tactile DPM helps dyslexic pupils engage tactile interactions such as touching and feeling objects in 3M basic learning.

(continued)

9	Audio

DPM helps teachers integrate effective audio resources for teaching dyslexic students in the 3M principles.

10	Neurological Impress

DPM content allows teachers to use the 'Neurological Impress' method to teach the basics of 3M.

11	Phonological Dyslexia

This DPM content allows teachers to identify phonological dyslexic pupils to learn the basics of 3M.

12	Double Deficit Dyslexic

This DPM content allows teachers to identify dyslexic students with 'Double Deficit' to teach the basics of 3M.

13	Reading Skills

This DPM content allows teachers to carry out reading skills activities to teach the basics of 3M.

14	Writing Skills

This DPM content allows teachers to carry out writing skills activities to teach the basics of 3M.

15	Low-Level Technology

This DPM content allows teachers to implement instruction with low-level technology to teach the basics of 3M.

16	Intermediate Level Technology

This DPM content allows teachers to implement instruction with medium level technology to teach the basics of 3M.

17	No Technology

This DPM content allows teachers to implement technology-free instruction to teach the basics of 3M.

18	High-Level Technology

This DPM content allows teachers to implement instruction with high-level technology to teach the basics of 3M.

Reliability test conducted on the survey questionnaire for all items revealed Cronbach's alpha coefficient of .912, indicating high reliability for all items as is shown in Table 2.
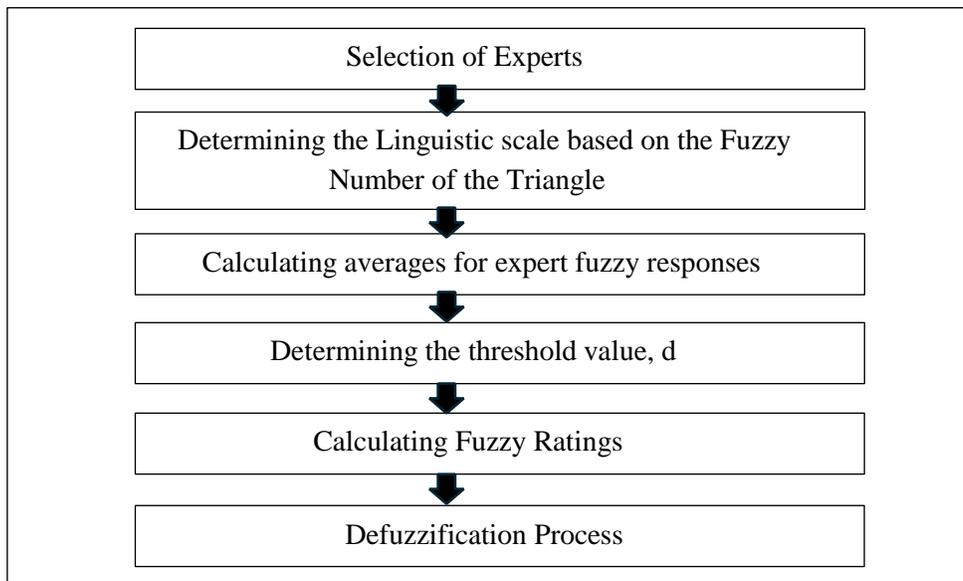
Table 2

Reliability Testing of Evaluation Questionnaire

Cronbach's alpha	Cronbach's alpha based on standardized items	N of items
0.912	0.899	24

Figure 2

Expert Selection Process

This study used a structured questionnaire with 18 items divided into two sections: Section A gathered demographic and professional data of experts (e.g., years of experience, specialization; as shown in Table 3), while Section B focused on expert consensus regarding the proposed curriculum model. The items covered six clusters: Individual Education Plan, multisensory learning styles, dyslexia types, teaching methods, language proficiency, and assistive technology (as shown in Table 1).

A purposive sample of 30 Special Education teachers (GP1–GP30), each with over 10 years of experience teaching dyslexic students, was selected. This follows guidelines by Delbeq et al. (1975) and Taylor and Judd (1989), emphasizing expert quality for valid findings. Jones & Twiss (1978) recommended 10–50 experts for a Fuzzy Delphi Method (FDM), which this study adhered to. The selection criteria, adapted from Delbeq et al. (1975) and Swanson and Holton (2009), included relevant academic qualifications, a minimum of five years' professional experience, strong commitment, and the absence of conflicts of interest. For data analysis, responses on the 7-point Likert scale were converted into three fuzzy values (see Table 4).

The following describes the FDM process:

Step 1: Selection of Experts

Table 3

Expert Demographics of the Usability Assessment Phase

Demography	Item	Frequencies	Percentage
Gender	Man	10	33.3
	Woman	20	66.7
Teaching Experience	2 to 5 years	1	3.3
	6 to 10 years old	3	10
	11 to 15 years old	4	13.3
	15 to 20 years	13	43.3
	over 20 years	9	30
Areas of Expertise	Academic Teacher Special Education Learning Problems	30	100

Step 2: Determining the Scale

In FDM, developing a linguistic scale is an important step to address the issue of fuzziness. Based on a 7 point Likert scale, three fuzzy values were added (as shown in Table 4). From this scale it is then translated into the triangular fuzzy number.

Table 4

Linguistic Scale Based on the Fuzzy Number of the Triangle

Level of Suitability	Fuzzy Scale (L)	Fuzzy Scale (M)	Fuzzy Scale (U)	Likert Scale
Extremely Suitable	0.9	1	1	7
Very Suitable	0.7	0.9	1	6
Suitable	0.5	0.7	0.9	5
Moderately Suitable	0.3	0.5	0.7	4
Not Suitable	0.1	0.3	0.5	3
Very Unsuitable	0	0.1	0.3	2
Extremely Unsuitable	0	0	0.1	1

Step 3: Calculation of Fuzzy Values

The raw data from the evaluation results are then scheduled in *Excel* template to obtain *the Fuzzy* value (n1, n2, n3), as well as the average Fuzzy value (m1, m2, m3) to obtain *the threshold value* (d). For the

purpose of obtaining an expert consensus value for each element, the threshold value must not exceed 0.2 (Cheng & Lin, 2002). The formula to obtain the *threshold* value (d) where the distance between two Fuzzy numbers is determined is as follows.

Formula 1

Formula for Determining Distance between Two Fuzzy Numbers

$$d(\bar{m}, \bar{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right].}$$

Using Formula 1, consensus on the usability of the 18 elements in the DCM was reached by all 30 experts, as indicated by a threshold value of d≤0.2d \le 0.2d≤0.2 (Cheng & Lin, 2002). Expert consensus was further confirmed through the consensus percentage, which was equal to or greater than 75% (Chu & Hwang, 2008). Under these conditions, each element was either accepted or discarded.

Step 4: Implementing the Defuzzification Process

The defuzzification process is then done to determine the position or priority of each element using the following formula:

    i.   A = 1/3 * (m1 + m2 + m3), or; ii.
    ii.   A = 1/4 * (m1 + m2 + m3), or iii.
    iii. A = 1/6 * (m1 + 4m2 + m3).

These formulas calculate the average or weighted average of the three values of the fuzzy number (m1, m2, and m3) to obtain the defuzzified score. The choice of formula depends on the particular context and considerations of the research (Ridhuan et al., 2014).

RESULTS

Table 5 reports the FDM threshold values (d) for each of the 18 elements in the Dyslexia Curriculum Model (DCM) as rated by 30 special education teachers (GP1–GP30). For every expert–element combination, an individual d value was calculated, and the mean d value per element was then obtained. The average threshold values per element ranged from 0.071 to 0.092, all of which are well below the cut-off point of d≤0.20 for accepting an item.

The lowest average d value was observed for Element 7 (d=0.071), indicating the strongest agreement among experts for this element. Elements 5, 8, 11, and 14 also showed high consensus with average d values of 0.073. Slightly higher, though still acceptable, values were recorded for Element 9 (d=0.083) and for Elements 16 and 18, which had the highest average d values of 0.092. Even in these cases, the values remained far below the rejection threshold, demonstrating that all 18 elements achieved satisfactory expert consensus. Consequently, none of the DCM elements needed to be discarded at this stage, and the full set of elements was retained for subsequent analysis and model refinement.

Table 5

Threshold Value (d), for Each DCM Element

EXPERT	ELEMENT																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 - GP 1	0.066	0.071	0.076	0.087	0.061	0.087	0.097	0.061	0.084	0.076	0.092	0.071	0.076	0.061	0.087	0.057	0.076	0.057
2 - GP 2	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.057
3 - GP 3	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.092	0.084	0.076	0.092	0.081	0.076	0.061	0.066	0.057	0.076	0.057
4 - GP 4	0.066	0.071	0.076	0.066	0.061	0.066	0.097	0.092	0.084	0.076	0.061	0.071	0.076	0.061	0.066	0.057	0.076	0.057
5 - GP 5	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.092	0.084	0.076	0.061	0.071	0.076	0.092	0.087	0.057	0.076	0.057
6 - GP 6	0.066	0.081	0.076	0.066	0.061	0.087	0.097	0.092	0.084	0.076	0.061	0.071	0.076	0.092	0.066	0.057	0.076	0.057
7 - GP 7	0.066	0.071	0.076	0.066	0.092	0.066	0.056	0.061	0.069	0.076	0.061	0.071	0.076	0.061	0.066	0.096	0.076	0.096
8 - GP 8	0.066	0.071	0.076	0.087	0.092	0.087	0.056	0.061	0.069	0.076	0.061	0.071	0.076	0.061	0.087	0.057	0.076	0.057
9 - GP 9	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.092	0.084	0.076	0.061	0.071	0.076	0.092	0.087	0.057	0.076	0.057
10 - GP 10	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.092	0.084	0.076	0.092	0.081	0.076	0.092	0.087	0.057	0.076	0.057
11 - GP 11	0.066	0.081	0.076	0.066	0.092	0.066	0.056	0.092	0.069	0.076	0.061	0.071	0.076	0.092	0.087	0.096	0.076	0.096
12 - GP 12	0.087	0.081	0.076	0.066	0.061	0.087	0.056	0.092	0.084	0.076	0.061	0.081	0.076	0.061	0.066	0.057	0.076	0.096
13 - GP 13	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.061	0.071	0.076	0.092	0.087	0.057	0.076	0.096
14 - GP 14	0.087	0.071	0.076	0.087	0.061	0.066	0.056	0.061	0.069	0.076	0.061	0.081	0.076	0.092	0.087	0.096	0.076	0.096
15 - GP 15	0.066	0.081	0.076	0.087	0.061	0.066	0.097	0.061	0.069	0.076	0.061	0.071	0.076	0.061	0.087	0.057	0.076	0.057
16 - GP 16	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.061	0.071	0.076	0.061	0.066	0.096	0.076	0.096
17 - GP 17	0.087	0.071	0.076	0.066	0.061	0.087	0.056	0.061	0.084	0.076	0.061	0.071	0.076	0.092	0.066	0.096	0.076	0.096
18 - GP 18	0.087	0.081	0.076	0.066	0.092	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.096
19 - GP 19	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.096
20 - GP 20	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.092	0.084	0.076	0.061	0.071	0.076	0.061	0.066	0.057	0.076	0.057
21 - GP 21	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.096
22 - GP 22	0.066	0.071	0.076	0.066	0.061	0.066	0.097	0.092	0.069	0.076	0.061	0.071	0.076	0.092	0.087	0.057	0.076	0.057
23 - GP 23	0.066	0.071	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.092	0.087	0.096	0.076	0.096

(continued)

EXPERT	ELEMENT																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
24 - GP 24	0.087	0.081	0.076	0.087	0.061	0.087	0.056	0.061	0.084	0.076	0.092	0.071	0.076	0.061	0.066	0.057	0.076	0.057
25 - GP 25	0.066	0.071	0.076	0.066	0.061	0.087	0.056	0.092	0.326	0.076	0.061	0.081	0.076	0.061	0.066	0.299	0.076	0.299
26 - GP 26	0.066	0.071	0.076	0.087	0.092	0.087	0.097	0.061	0.069	0.076	0.061	0.081	0.076	0.092	0.066	0.299	0.076	0.299
27 - GP 27	0.087	0.081	0.076	0.087	0.092	0.066	0.056	0.092	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.057
28 - GP 28	0.087	0.081	0.076	0.087	0.092	0.066	0.056	0.061	0.069	0.076	0.061	0.071	0.076	0.061	0.087	0.096	0.076	0.096
29 - GP 29	0.087	0.081	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.061	0.066	0.096	0.076	0.096
30 - GP 30	0.066	0.071	0.076	0.066	0.061	0.066	0.056	0.061	0.069	0.076	0.092	0.081	0.076	0.092	0.087	0.096	0.076	0.096
Average value d per item	0.075	0.076	0.076	0.075	0.073	0.075	0.071	0.073	0.083	0.076	0.073	0.076	0.076	0.073	0.075	0.092	0.076	0.092

Table 6 shows that all 18 elements of the DCM met the FDM acceptance criteria. The threshold values d for all items were low (0.073–0.092) and expert consensus ranged from 93% to 100%, exceeding the 75% minimum. Core pedagogical components (objectives, intervention strategies, methods/techniques, assessment) and key multimodal and dyslexia-related elements (visual, tactile, phonological dyslexia, double-deficit dyslexia, reading and writing skills) recorded the strongest agreement. Slightly higher d values were observed for the audio and technology-related items, but these still fell within the acceptable range, indicating that none of the elements needed to be rejected and all were retained in the DCM. Table 6 shows the expert consensus to accept or reject each element identified based on the Triangular Fuzzy Numbers condition.

Table 6

Expert Consensus Based on Triangular Fuzzy Number Criteria

Item/ Element	Element	Triangular Fuzzy Numbers Condition		Expert Deal
		Threshold, d Value	Percentage of Expert Group Consensus %	
1.	Objectives DCM provides a clear framework for teachers to determine individual educational objectives for dyslexic students.	0.075	100%	Accepted
2.	Intervention Strategies DCM supports teachers in identifying and selecting appropriate intervention strategies to teach the 3M principles.	0.076	100%	Accepted
3.	The DCM approach incorporates a variety of teaching approaches that facilitate teacher selection and adjustment based on the individual needs of dyslexic students.	0.076	100%	Accepted
4.	Methods or Techniques DCM provides effective teaching methods or techniques that can be adapted to various levels of ability of dyslexic pupils.	0.075	100%	Accepted
5.	DCM Assessment allows teachers to plan and implement formative assessments that reflect students' progress in the 3M fundamentals.	0.073	100%	Accepted
6.	Visual DCM helps teachers provide visual teaching materials that make it easier for dyslexic students to understand the basics of 3M.	0.075	100%	Accepted
7.	Tactile DCM helps dyslexic pupils engage tactile interactions such as touching and feeling objects in 3M basic learning.	0.073	100%	Accepted

(continued)

8.	Audio DCM helps teachers integrate effective audio resources for teaching dyslexic students in the 3M principles.	0.083	97%	Accepted
9.	Neurological Impress DCM content allows teachers to use the 'Neurological Impress' method to teach the basics of 3M.	0.076	100%	Accepted
10.	Orton Gilingham This DCM allows teachers use the Orton Gilingham method to teach the basics of 3M.	0.073	100%	Accepted
11.	Phonological Dyslexia This DCM content allows teachers to identify phonological dyslexic pupils to learn the basics of 3M.	0.073	100%	Accepted
12.	Double Deficit Dyslexic This DCM content allows teachers to identify dyslexic students with 'DoubleDeficit' to teach the basics of 3M.	0.076	100%	Accepted
13.	Reading Skills This DCM content allows teachers to carry out reading skills activities to teach the basics of 3M.	0.076	100%	Accepted
14.	Writing Skills This DCM content allows teachers to carry out writing skills activities to teach the basics of 3M.	0.073	100%	Accepted
15.	Low-Level Technology This DCM content allows teachers to implement instruction with low-level technology to teach the basics of 3M.	0.075	93%	Accepted
16.	Intermediate Level Technology This DCM content allows teachers to implement instruction with medium level technology to teach the basics of 3M.	0.092	100%	Accepted
17.	No Technology This DCM content allows teachers to implement technology-free instruction to teach the basics of 3M.	0.076	93%	Accepted
18.	High-Level Technology DCM content allows teachers to implement instruction with high-level technology to teach the basics of 3M.	0.092	93%	Accepted

DISCUSSION

The Dyslexic Curriculum Model (DCM) was assessed for its functionality and curricular relevance by experts using the Triangular Fuzzy Number approach. Findings from the study show strong expert support: all assessed elements recorded a d value of 0.075, and this value is significantly lower than the 0.20 threshold commonly used for Fuzzy Delphi analysis (Murray et al., 1985). In addition, more than 93%

expert consensus was established across all components, with several items indicating total agreement. These findings support not only the DCM's internal consistency but also its pedagogical relevance, particularly for designing a responsive and inclusive language curriculum for learners with dyslexia.

Apart from that, main components DCM, such as Objectives, Intervention Strategies, Instructional Approaches, Teaching Methods and Assessment obtained unanimous consensus. These components are critical in developing a cohesive language curriculum, especially one that caters for neurodiverse students. Snowling and Hulme (2012) support this and state that language interventions for dyslexic students must be structured, explicit, and repetitive—all of which are within DCM. It is the clarity and consistency of these components that establish DCM as a dependable model for developing a language curriculum that prioritizes accessibility and individualization.

On top of that, the model's emphasis on multisensory engagement (via Visual, Tactile, and Auditory modalities) overcomes fundamental limitations in language learning for dyslexic pupils. These components, which received consensus values in excess of 97%, are consistent with language acquisition theories that argue for multimodal input and interaction (Shaywitz, 2003; Birsh, 2011). By supporting language development through numerous sensory pathways, DCM offers a framework for differentiated instruction, which is an important component of current language curriculum design.

In addition to established methods, the use of Animal-Assisted Teaching (AAT) has been touted as a new and effective component of language instruction. It leverages the presence of trained animals during lessons to provide a relaxing and encouraging environment (Anderson & Olson, 2006). Previous studies have shown that AAT has the potential to increase reading fluency as well as oral confidence in children with literacy difficulties (Friesen, 2010; Gee, Fine, & McCardle, 2017). As such, integrating AAT into the language curriculum not only promotes emotional regulation but also encourages verbal expression and engagement, both of which are crucial outcomes in communicative language teaching approaches.

Another component of DCM, the Neurological Impress method, highlights language-focused instructional design. This paired reading approach, in which the teacher and student read a material concurrently, has been associated with enhanced fluency, vocabulary acquisition, and prosody (Heckelman, 1969; Rasinski, 2003). The integration of the Neurological Impress method in DCM is proven to be able to improve the model's alignment with fluency-based language interventions, providing a valuable tool for learners with reading difficulties.

Not just that, DCM brings with it precise diagnostics by incorporating several types of dyslexia, including phonological and double deficit dyslexia. Doing so enables a curriculum to be dynamic, focused and in tandem with differentiated language instruction frameworks that take into consideration the main causes of reading difficulties (Torgesen, 2004). Furthermore, DCM is aligned with the main objectives of a language curriculum, demonstrated by its focus on reading and writing skills. This has also been validated and obtained unanimous agreement among the experts consulted.

Another important point is that elements such as Low, Medium, and High-Level Technology all received excellent scores, with consensus rates ranging from 93% to 100%. This indicates that from a technological point of view, DCM provides flexible options and this is agreed upon by experts. Importantly, the "No

Technology" option also received expert endorsement, suggesting that DCM's language teaching approaches may be used in a wide range of school settings, including rural and underprivileged areas. This conforms to UNESCO's (2020) commitment to equity and adaptability in curriculum implementation.

Besides, DCM also acknowledges the psychosocial aspects of language learning, particularly for students who may feel embarrassed or anxious as a result of ongoing difficulties with reading and writing (Mortimore and Crozier, 2006). Such acknowledgement comes in the form of DCM's emphasis on teacher-student rapport and emotional well-being that goes along with socio-emotional learning concepts found in progressive language curriculum.

In a nutshell, DCM is more than just a learning and teaching tool for dyslexia intervention. It is essentially a robust language curriculum model tailored to cater different types of learners. Additionally, its multifaceted structure that encompasses cognitive, sensory, emotional, technological, and affective (using AAT) elements makes it a very suitable model for nationwide implementation. Also, it is believed that the model can be further improved to increase its efficacy. This can be done by having future work that looks into designing teacher training programs that are aligned with recognized language curriculum standards, examining AAT integration in classroom literacy practices and having broader validation studies done across the country.

CONCLUSION

The DCM has been found to be useful as a tool in instructional planning and also as a guiding framework in improving education for dyslexics in Malaysia. This is illustrated by the excellent expert consensus obtained by the eighteen (18) elements in DCM. The model also focuses on an IEP approach tailored to specific forms of dyslexia, allowing for specific variation in content, pedagogy, and assessment. It also holds the promise of improving instructional planning, reducing teacher trial-and-error, and strengthening learners' engagement, confidence, and progress. These could be achieved via turning evidence-based elements into practical guidance. Consequently, the DCM can be employed as an important guide in special education to help dyslexic students develop academically and socially.

One of the main strengths of DCM is its capacity to seamlessly combine structure and flexibility, ensuring that teachers are guided without being constrained and students are helped without being stigmatised. In addition, it evens out the pressure on both teachers and learners while development is taking place. This is a breath of fresh air as education systems around the world pivot towards inclusivity and personalized learning, DCM and similar models serve as a guiding framework that provides flexibility and clarity.

That said, accepting the model is just the first step start of a long and arduous campaign, with the next hurdle being transforming consensus into capacity. In the absence of systematic training, monitoring, and policy integration, the model will not be able to live up to its huge potential. Such a misfortune will deprive teachers of the support that they desperately need and may further dampen their spirit over time. As such, it would be a good idea to develop a national DCM Professional Development Module, complete with a certification pathway and digital toolkit. The development of such a module may bring about a sustainable

implementation of curriculum while maintaining clarity. It is also advised that the model's suitability for other languages be assessed.

Last but not least, it is recommended that future studies look into the effects of DCM on student identity, teacher autonomy and school culture, as well as its impact on education outcomes. Hopefully, placing DCM at the heart of inclusive education would decisively empower education to be the bridge between what is and what is possible for students.

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