

# DEVELOPMENT OF SYMPTOMATIC BEHAVIOUR SCREENING TOOL (SYMBEST) USING WEB BASED SCREENING APPROACH TO IDENTIFY CHILDREN WITH DEVELOPMENTAL DELAYS

Shyielathy Arumugam  
*Universiti Pendidikan Sultan Idris, Malaysia.*

KwayEng Hock  
*Universiti Pendidikan Sultan Idris, Malaysia.*

## **Abstract**

*This research suggests that developmental screening, based on behavioural symptoms, should be promptly addressed and the practice must be introduced in the early childhood education school to reach a justified consensus between the primary care practitioners and the school system. The focus of this study is to develop a Symptomatic Behaviour Screening Tool (SymBest) for early childhood education (ECE) educators to identify symptomatic behaviours which is an indication of developmental delays among children aged 3 to 4 years old. 18 experts were selected from the field of medical, behaviourism and education to validate the constructs and the items and the findings were analysed by the Fuzzy Delphi Method (FDM). SymBest is a fully featured web app with several functions like instant scoring upon, scores interpretations, overall interpretation, constructs and items in dual languages (English and Bahasa Melayu) and saving the report in the PDF file. SymBest is also optimised for mobile and personal computer users with Android, IOS and PC operating system. This web app tool was developed to encourage Early Childhood Educators to practice early identification, assessment and provide intervention within their capacity. SymBest has potential commercialization for early childhood education centres.*

**Keywords:** *Web Application, Symptomatic Behaviour, Screening Tool, Developmental Delays.*

## **I. INTRODUCTION**

Earlier identification of the developmental delays in children gives more significant focus on general assessment and the resultant awareness on the developmental norms (Robinson and Dunsmuir, 2010). Traditionally, infants, toddlers and preschoolers are expected to develop skills and behaviors that are typical to their peers and culture. In the context of early childhood, there is a broad range of reference on what is considered as typical development (Jennings, 2012) When developmental skills are delayed beyond the family and cultural norms, the child and his or her family can experience problems as a result. However, in evaluating and promoting optimal child development and well-being, the domains of development and behaviour must be considered together as they are not separate constructs but rather parts of the whole (Weitzman and Wegner, 2015). In recent years, we have observed more children coming to school with behaviour problems than ever before, and teachers face the challenge of managing children's behaviour (Beazidou, Botsoglou, and Andreou, 2013). Most schools wait for children to be referred to when problems are detected, unlikely to be proactive by identifying the problems before it becomes significant. As such, schools need access to screening tools to screening children universally, to provide reliable results, provide information to school personnel for assistance, and does not require extensive training to administer, scoring or interpret (Edwards, 2009)

In Malaysia, screening of children with developmental delays or special needs is shouldered by the Ministry of Health (MOH). The ministry is also entrusted to provide early intervention programs. Hence, in order for the ministry to strategize, develop appropriate intervention programs and cater to the demand, early identification and data pertaining to early identification are vital. Legislatively, only doctors and paramedical personnel are qualified to certify an individual as being a person with special needs. The concept that is being cultivated in Malaysia is that the screening of an individual for special needs is usually done by medical professionals rather than educationist by using

psychometric assessment tools (Haniz Ibrahim, Siti Eshah Mokshein, Ardzulyana Anal, & Syamsinar Abd Jabar, 2014).

A screening tool to detect developing behaviour problems is as important as knowing the functions of the behaviour. School-based screening for behavioural symptoms results in early identification of delays and timely intervention planning (Davis, Young, Hardman, & Winters, 2011). Here and now, there is a lack of screening tools for early childhood programs in Malaysia, especially in the government aided child care centers. This minimize the capability to accurately identify children at risk of emotional and behavioral disorders. It is vital for schools and educators to utilize early identification methods through a comprehensive and user-friendly screening tool. A brief and informative screening tool will surely encourage ECE educators to cultivate the practice of early identification in the classroom. A manual screening procedures with self-scoring method will typically reduce the usage interest among educators as it is tedious and time consuming. Hence, to encourage and empower educators for screening a web app screening tool was developed. This web app tool is designed to meet user's needs, with necessary requirements to fit the screening purpose. Commonly Web App includes benefits like allowing multiple users access to the same version of the application without the needs to install. Besides that, it can be also accessed through various platforms like desktops, laptops and mobile. Most importantly, web app can be accessed through multiple browsers like Google Chrome, Mozilla Firefox and Safari. Based on this, web app was found suitable as a Sym Best platform mainly because, it can be designed for wide users and anyone can access over the internet. SymBest uses the Google Chrome browser to be compatible with laptops, desktops and mobile.

## II. LITERATURE REVIEW

### A. *Development Delays in Early Childhood.*

Developmental normality can be described from 3 perspectives, a) statistical deviance; b) sociocultural norms and, c) mental health definitions ((Parritz and Troy, 2014)). From the perspective of statistical deviance when a child displays behaviours which are above or below of the age expectant such as dependency or assertiveness, it is considered to be developmentally delayed. Similarly, in sociocultural norms, children who unable to comply with age-related, gender-specific or culturally acceptable expectations are perceived as challenging, struggling or delayed. As such, from the mental health perspective children who have a poor quality of life or function poorly or exhibits, specific kind of symptoms might be at risk of a disorder. Thus, age is an index of developmental level when measuring developmental delays in children ((Wicks-Nelson and Israel, 2006). A diagnosis from the medical experts will determine if the child is developmentally delayed. Monitoring children and appointment follow ups are based on clinical judgements not merely by the standardized assessments tools alone (Valla, Wentzel-larsen, Hofoss, & Slinning, 2015). A lack diagnosis can be a treat to essential services like counseling and medical management and slow down the research efforts towards improving educational and therapeutic option (Bowling et al., 2017)). Many children diagnosed with developmental delays id predicted to have poor academic skills and high risk of behavioral outcomes at preschool entry (Nelson, Dudovitz, Coker, & Elizabeth, 2016). However, judgements about behavior require developmental norms, which describe the typical rates of growth, the sequence of growth, and forms of physical skills, language, cognition, emotion and social behavior. These serve as developmental standards to evaluate the possibility that something is wrong. IDEA Act defines a child with a disability as, a child aged three through 9 experiencing developmental delays and as measured by appropriate diagnostic instruments and procedures, in one or more of the following areas: physical development, cognitive development, communication development, social or emotional development, or adaptive development. Symptomatic behaviors identified at risk of developmental delays can be observed across 4 developmental domains that are sensory and motor development, language and communication development, social and emotional development and cognitive development. Creativity development is widely used to assess children from the perspective of education. The functions of each domain are often interrelated to another for optimal functioning skills. Conclusively, follow-up information on a child's functioning is essential

for timely recognition of symptoms and referral for intervention in order to prevent further delays. Driven by the importance of early identification, there is a critical need for a screening tool that is relatively simple to conduct and inexpensive (Schepers, Dekovi, & Feltzer, 2012).

### ***B. Behaviour Problems in Early Childhood.***

Behaviour Problems refers to any behaviour viewed as atypical, odd or abnormal (Wicks-Nelson & Israel, 2006) that interferes with a child's cognitive, social, or emotional development. It is found inappropriate because it is harmful to a child, his peers or adults around them (Kaiser & Rasminsky, 2009). Behaviour problems referred to as challenging behaviours is one of the core features of children at risk of developing special needs. Behaviour which is inappropriate to the situation, repetitive and not age-appropriate some early alarm for parents and teachers of young children. In 2014, The US Census Bureau estimated a population of approximately 1.8 billion of youth from 5 to 19 years around the world (Child Mind Institute, 2015). Similarly, there was a community study conducted to estimate the prevalence of children and adolescents with mental and emotional disorders from 27 countries and every world region. The meta-analysis study indicated a pooled estimation of 13.4% (241million) children and adolescents affected by any mental disorders. The most common group of mental disorders are anxiety disorders, affecting 117 million; disruptive behavior disorder, affecting 113 million; ADHD, affecting 63 million; and depressive disorders, affecting 47 million (Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015).

When referring to a behaviour problem, there are several terminologies like mental disorder, emotionally disturbed, disruptive behaviour, defiant behaviour and challenging behaviour are used in the literature writings to provide significant and relevant definitions to it. In general, all the terms being used refer to the types of behaviour problems found in young children. Emotionally disturbed is the label currently used in the federal legislation and regulations regarding special education. All these terms are commonly used to describe behaviours that interfere with an individual's care and education, as well as socialisation and interactions with peers (Bayat, 2015). However, behaviourally disordered is preferred by some professionals in the field of special education because it is a more accurate descriptor of the socialisation difficulties of children and youths (Kauffman & Landrum, 2012). IDEA act defines emotional disturbance as a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance : (a) an inability to learn that cannot be explained by intellectual, sensory, or health factors, (b) an inability to build or maintain satisfactory interpersonal relationships with peers and teachers, (c) inappropriate types of behavior or feelings under normal circumstances, (d) a general pervasive mood of unhappiness or depression and (e) a tendency to develop physical symptoms or fears associated with personal or school problems (IDEA, 2004)

In recent years, challenging behaviours among young children is most likely due to some emotional disturbance, which is so much being a challenge for the teachers in the learning classrooms. In this research, the variable behaviour problems are taken very seriously about being studied as it is a concern of many ECE educators. The unmet emotional need of children often turns out to be a cause of educators having a disruptive classroom. It is indeed important for ECE educators to have a clear understanding of what is behavior problems and the behaviors classified to be symptomatic to a disorder. Identifying behaviors to be symptomatic or typical as early as possible may lead to formal clinical assessment where early intervention is suggested.

### ***C. Importance of Early Identification in ECE centres.***

Given that children spend countless hours at school, teachers are an invaluable resource for referring children in need of behavioural, emotional, and academic intervention. General education educators are the primary link between children's exhibiting problematic behaviour and receiving access to school-based services ((Eklund et al., 2009). Identifying symptoms of delays may help educators to understand the patterns of abilities like cognitive abilities or adaptive skills of children, and how it is affected due to the diverse biological constrain children have (Guralnick, 2017). Early identification of children helps schools to provide timely intervention and support to address behaviour problems before they become entrenched and difficult, if not impossible, to manage (Davis

et al., 2011). Early identification of children who are at risk of developing emotional and behaviour disorders helps school educators and other professionals to provide intervention sessions on time. Intervention on time is also a support to address emotional and behavioural issues in young children before it gets rooted and difficult (Eklund et al., 2009). Although there is a reduction in certain kind of problems around 5 years old, a wide range of disorders has their beginning in the preschool years (Poulou, 2015). Emotional and behavioural problems in young children mostly invisible in early childhood. Therefore, educators often miss or overlook the traits or symptoms. Similar to it, not many children, especially in the mainstream early childhood programs, have a prior developmental diagnosis of special needs. Hence, little attention is paid to the earliest onset of these problems in the early childhood years (Poulou, 2015). In addition to early identification, availability of a feasible screening tool will add value to opinion or decision made on the child's symptoms by educators.

#### *D. The Need For Screening.*

In the current practice, screening young children for developmental delays is done in primary care settings. A primary objective when administering an instrument is to collect reliable and valid information to use in decision making. Many times the measures used to collect targeted information may be lengthy, using long, detailed instruments to provide a wealth of information about numerous domains of functioning (DiStefano & Kamphaus, 2007). Medical practitioners use several clinical assessment instruments to gain first-hand information about the child's issues, and the proper diagnosis is given upon that. Educators and school team, based on their observation in the classroom, referral suggestion is given to the parents for clinical assessment. However, classroom educators or school team is not eligible to assume the child's diagnosis. In the case of a child attending early childhood programs, educator's prior information and knowledge on early identification is a crucial step for a referral. Many children are deprived of early intervention because most of these problems remain undiagnosed, and sometimes, they are of interest only when children are unable to adapt to school requirements and teachers complain about their behaviour (Balaj, Albu, Porumb, & Miclea, 2011). Unlikely, to record the observational details, ECE educators or school team may not be able to use the clinical assessment instrument for screening purpose in the classroom setting. This is because ECE educators or school team is not trained to admin the clinical assessment instruments. Most of the clinical instruments are (a) excessive time required for administration, scoring and interpretation; (b) prohibitive costs; and (c) development with non-representative norming samples (Studs & Van Zyl, 2013). Screening is important for educators because, most oppositional behaviours, often pose a challenge in the classroom and leave adverse effects on classroom functioning. Disruptive and defiant attitudes and actions can hinder class activities and make learning difficult for both the child with disruptive behaviours and other children in the classroom. The time teachers spend focusing on correcting disruptive and oppositional behaviours takes away from time that could be spent achieving academic goals (Purpura & Lonigan, 2009). It is a blessing indeed for educators to have a structured teacher-rated behaviour screening instrument, which is brief, easily scored, user-friendly and freely available. In conclusion, the purpose of screening for early identification in the classroom setting is not to lamely label children with or without disorders, but instead promoting early detection and intervention in such cases (Studs & Van Zyl, 2013).

In Malaysia, the screening tools used in the primary care settings are like Checklist For Autism in Toddlers (CHAT), Modified Checklist for Autism in Toddlers (M-CHAT) and Social Communication Questionnaire (SCQ) (Clinical Practice Guidelines 2014). However, in the government education system, educators are yet to discover or develop one that can be used to make a functional assessment for children at-risk in the classroom. The norm practice is that educators will identify students at risk of developmental delays through random observation and suggest for referral verbally to the parents. Especially children with special needs placed in the mainstream schools, educators feel helpless and face challenges to address the early identification to parents. Adding to it, lack of suitable screening tools to report observations unable teachers to move forward in solving the issues faced both for confronting parents or planning intervention treatment. Functional behaviour analysis or functional behaviour assessment does not widely practice in Malaysian's government education system. The need for an assessment scale that is age-appropriate and specific measure the behavioural problem of

young children for referral and treatment in Malaysian's government preschools is crucial. Relatively in Malaysian's public school system, very few studies conducted on the developing screening tool focusing on preschool-age children at-risk of emotional and behaviour disorders.

### III. PROBLEM STATEMENT

Primarily, the reality in Malaysia, developmental screening or commonly known as developmental surveillance is available and done by primary care practitioners alone (Hussain Iman Muhammad Ismail, Ng H. P, & Thomas, 2017; Paediatric Department Hospital Ipoh, 2008). The reason being, the primary care settings are the place where most children younger than five years old are seen and ideal for developmental and behaviour screening (American Academy of Pediatrics, 2002). However, screening for early identification is also crucial to practice in the school system. Since screening is commonly to be MOH's responsibility alone (Faridah M. Said, Jamilah Othman, Maimunah Ismail, Bahaman A. Samah, & Khairudin Idris, 2011), the school system in Malaysia in all education levels are not introduced to use screening tools for early identification.

Secondly, in the education system currently, assessment is available in the form of the checklist for literacy, numeracy, and writing, but less for behaviour symptoms to identify developmental delays of children age four years old and below. The available tools are not practical to be applied somewhat adapted or adopted for children aged 3 to 4 years old to identify symptomatic behaviours.

Third, when educators fail to identify the potential problems in a child's development and ensure development is on target (Slentz, Early, & McKenna, 2008) most of the time the symptoms are left unaddressed (Miller, Smith-bonahue, & Kemple, 2017) for referral and special education services. When parents overlook the traits of developmental delays, educators are the second potential people to identify children with developmental delays from the symptomatic behaviours. Alternatively a failure to provide early intervention timely due to lack of early identification, inaccurate diagnosis may result in grave consequences (Koegel, Koegel, Ashbaugh, & Bradshaw, 2014) like the persistence of behavioural problems, poor academic performance and prevention from reaching functional abilities.

Fourth, educators, who are the primary early detect have reported both a lack of preparation and knowledge on early detection of children with social and behavioural needs (Stormont, Reinke, & Herman, 2017). Since not all children at-risk of delays are identified by their parents at home (Zhang & Morrison, 2018), early detection in the educational setting is essential.

Finally, the lack of behavioural support from the school management is also another reason why educators are facing challenges to manage children's behavioural problems (Miller, Smith-bonahue, & Kemple, 2017). It is undeniable that educators need support from the school management for resources and guidance (Nye et al., 2016). Proper supervision from the school management, access to mental health consultants and cooperation from co-workers can be an excellent resource for providing ECE educators with on the job support to address children's behaviour problems (Miller, 2014).

Hence to enhance ECE educators' knowledge in the behaviour problems management and early identification, there is a need to develop a screening tool that precisely screens children with behavioural issues. Thus, this study is about developing a screening tool for ECE educators to identify symptomatic behaviours that may relate to developmental delays among young children in early childhood education centres'.

### IV. THEORETICAL FRAMEWORK

The foundation of this research is based on Arnold Gesell's Maturation Theory, Piaget's Theory of Cognitive Development explicitly referring to the Preoperational Stage, and Developmentally Appropriate Practices to assist the development of the constructs and items of the screening tool. This research will correlate several child development theories and the Developmentally Appropriate Practices Framework by considering the child as a dynamic individual with differentiated abilities.

Theory of maturation explains the growth in various dimensions or aspects of physiology like birth, age and maturity. Gesell promotes nature as a significant influence on development. According to Arnold Gesell (1928), growth in human can be viewed as changes of size, form, weight and structure, and it is a continual process. From another perspective, growth is a function of the body comparable to secretion or respiration. Finally, growth is also viewed from the dynamic aspect of behaviour that is as life grows, it reacts in a changing manner progressively and susceptible to a systematic observation. Gesell elaborated that the growth of behaviour certainly has some dependable connection to the growth of one's nervous system of the body. As the nervous system matures through the emergence of a sequence of behavioural values, mental growth is assured (Gesell, 1928). This means the conduct behaviour of a child is closely related to his or her expected maturational stage, which reflects the integrity of the nervous system. Having said that, patterns of behaviour follows an orderly genetic sequence in their emergence in all society of life (Thelen & Adolph, 1992). Hence, he believes that it is essential to evaluate a child's performance on a series of developmental and academic tasks in relation to the sequential ages and stages of child development in domains of cognitive, motor, language and social-emotional to best describe a child's collective behaviour and performances ((Guddemi et al., 2014). Therefore, it is assumed that fundamentally the law of growth or development is universal, but the abnormalities in domains of development which Gesell addressed as the potentially dangerous deviations are highlighted because they serve to focus attention on the underlying mechanism of all growth. In SymBest the deviations addressed by Gesell are determined to be the items under each construct. The theory of maturation was developed to educate medical practitioners, educators and parents about "normal development" in order to establish a basis for comparison (Curtis, 2011). Hence, besides medical practitioners, educators and parents are also expected to recognise the differences between typical behaviour and symptomatic behaviours in order to make meaningful decisions for the benefit of the child. Gesell in his book "The Mental Growth of a Preschool Child" have discussed the norm of developmental domains like motor and adaptive development, language development and social development with typical milestones to be achieved from birth to 6 years old (Gesell, 1925). Thus it is appropriate that the developmental domains as per suggested by Gesell are chosen to be the measurement constructs of SymBest. Relating this, the items under each domain are for children aged 3 to 4 years old. The items are basically the red-flags of each domain which indicates the developmental delays. To support further the selection of domains of development, Piaget's view was reviewed.

In Jean Piaget's view, intellectual or cognitive development controls every other aspect of development, which is continual in all children in the same order. A child is pronounced as developing when significant changes are noticed in thinking. Having said this, the stages of age for children to reach optimal development is based on individuality which is both biological and psychological as well as factors emerging in the child's physical and social environment (Ramesh C. Mishra, 2014). The optimal function of domains like sensorimotor, language and communication and social and emotions closely related to the development of cognition. Unlike Gesell, Piaget's stages are not defined in terms of age; instead, they are defined in terms of performance in stages by the number of cognitive stimulations received (Mueller & Eycke, 2014). Piaget believed that children all pass through the same stages when developing thinking skills. However, it is the age at which children accomplish these stages of development can vary. Just as Gesell, Piaget too believed that when a child's development is not reaching the expected milestones, then they are most likely to experience developmental delays, which require further assessments for a confirmed diagnosis. Conclusive from both the theories, it is found that measuring delays are essential based on the developmental domains and the milestones which indicates the red-flags. With the support of the theories, the construct and items of SymBest were determined. The child developmental domains as constructs and the red-flags of the milestones are the measurement elements of SymBest. To strengthened the development of SymBest, the Developmentally Appropriate Practice Framework (DAP) was adapted to justify the needs of screening practice in ECE centres by ECE educators.

There are three core considerations in DAP for ECE educators to keep in mind while decision making. Amongst them are the importance of knowing child developmental domains and age-related

characteristics, attempts to know about each child as an individual and educators knowledge on the social and cultural context the children live in are meeting to the purpose of developing SymBest. Educators who are knowledgeable about child development can make broad predictions about what children of a particular age group typically will be, what they typically will and will not be capable of, and what strategies educators can employ to promote learning and development ((National Association for the Education of Young Children (NAEYC), 2009). In the process of knowing each child as a person, educators are encouraged to use varieties of methods like observation, checklist, rating scales, clinical interviews, parents interviews, the examination of children's work and individual child's assessment. Necessarily, knowing every child help educators to see children as they are to make decisions that are developmentally appropriate (National Association for the Education of Young Children (NAEYC), 2009). Although DAP guidelines are were intended as one index of quality for the best practices for typically developing children, the standard of developmentally appropriate practices is equally beneficial for children with special needs (Atwater, Carta, Schwartz, & McConnell, 1994). Educators effort to identify and address children with symptomatic behaviours in the classroom is undoubtedly a starting for decision making and provide an excellent base for incorporating intervention components. In recent years, in Malaysian Educational Blueprint, including children with special needs in the less restrictive educational environment as early as possible has been a great move since the year of 2013. The idea of inclusive education implementation in all educational level was strengthened further in 2018 by the ministry that by the year of 2025 70% of children with special needs will be included in the government schools by stages. The shift in this focus has surely presented some challenges for early childhood professionals, for it requires a meaningful collaboration between the field of early childhood and early childhood special education. In line with this, early childhood educators role in identifying children with symptomatic behaviours leading to developmental delays is definitely an advantage for both educators and children for a successful learning environment. Thus, the adaptation of DAP together with the theory of maturation and the theory of cognitive development is an ideal decision to meet the development features of SymBest measurement.

## V. OBJECTIVE OF THE STUDY

To develop a web app screening tool for educators in early childhood education centres to screen children with symptomatic behaviour indicating developmental delays.

## VI. RESEARCH QUESTION

What is the design and development model of the screening tool to assess children's symptomatic behaviour?

- a) What are the suitable constructs of measurement for screening symptomatic behaviours of children based on expert's consensus ?
- b) What are the suitable items in the main constructs for screening symptomatic behaviours of children based on expert's consensus?
- c) What are the sequence priorities of the items in the screening tool based on expert's consensus?

## VII. METHODOLOGY

In order to achieve the objectives of this phase, a screening tool will be developed along with the Fuzzy Delphi Method (FDM) to answer the research questions. The Fuzzy method is an analytical method based on the Delphi method that draws on the idea of the Fuzzy theory. This method uses the independent consensus of a group of experts in the subject field. The purpose of this method was to elicit perceptions or judgements held by "experts" knowledgeable in a specialized area (Blair & UHL, 1993). A survey questionnaire was developed to get experts view on the appropriateness of the constructs and items suggested to form the screening tool. The questionnaire consists of 7 sections with 7 point Likert scale. Section A is experts demography; Section B is experts view on the constructs of SymBest; Section C is experts view on the items of construct sensory and motor

development ; Section D is experts view on the items of construct language and communication development; Section E is experts view on the items of construct social and emotional development ; Section F is experts view on the items of construct cognitive development and Section G is experts view on the items of construct creativity. The constructs and the items are the developmental domains of children age 3 and 4 years old.

The FDM will be conducted using the following steps:

*Step 1: Selection of experts to validate the screening tool.*

A total number of 18 experts was selected for the study for the process of FDM. The 18 experts are from clinical and education field.

*Step 2: Converting the linguistic variable into triangular fuzzy numbers.*

The linguistic scale is a Likert scale with the addition of fuzzy numbers (Chang, Hsu & Chang, 2011). The Triangular Fuzzy Number represented as value  $m_1$ ,  $m_2$  and  $m_3$  often written as ( $m_1$ ,  $m_2$ ,  $m_3$ ). Whereby  $m_1$  is the minimum value,  $m_2$  is the most plausible value and  $m_3$  is the maximum value. These Triangular Fuzzy Numbers are used in the fuzzy scale to interpret the linguistic variables to fuzzy numbers. Three fuzzy numbers are given to every responses as shown in Table 1.

Table 1: Linguistic variable into fuzzy numbers.

Likert Scale	Scale Anchors	Fuzzy Scale		
		$m_1$	$m_2$	$m_3$
1	Totally Disagree	0.9	1.0	1.0
2	Strongly Disagree	0.7	0.9	1.0
3	Disagree	0.5	0.7	0.9
4	Neither Agree or Disagree	0.3	0.5	0.7
5	Agree	0.0	0.3	0.5
6	Strongly Agree	0.0	0.1	0.3
7	Totally Agree	0.0	0.0	0.1

*Step 3: Average Fuzzy Number*

To identify the average responses for every Fuzzy numbers and the distance between the average. The distance between two Fuzzy numbers  $m = (m_1, m_2, m_3)$  and  $n = (n_1, n_2, n_3)$  is computed by the following formula(Chang, Hsu, & Chang, 2011):

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

*Step 4: Identifying threshold value “d”.*

The threshold is important to identify consensus level among experts (Thomaidis, Nikitakos, & Dounias, 2006). Threshold value is very important in determining consensus among experts. If the threshold “d” less or equal to 0.2 ( $\leq 0.2$ ), hereby consensus among expert is attained (Cheng & Lin, 2002).

*Step 5: Identifying percentage of experts consensus for all the items.*

While the overall group consensus should be more than 75% (>75%) for each elements; otherwise the survey has to be repeated (Chang et al. 2011).

#### *Step 6: Defuzzification*

Defuzzification information is very much needed to justify experts consensus on the constructs and items of the instrument. In Defuzzification techniques, fuzzy numbers are converted to crisp real number (Thomaidis, Nikitakos and Dounias 2006). In the defuzzification process there are 3 the formulas used to determine the score or ranking items. The formulas are:

- i.  $A_{max} = 1/3 * (m_1 + m_2 + m_3)$
- ii.  $A_{max} = 1/4 * (m_1 + m_2 + m_3)$
- iii.  $A_{max} = 1/6 * (m_1 + m_2 + m_3)$

Upon achieving group consensus of the experts by adding the fuzzy numbers for every items, the alpha- cut level is identified. Alpha-cut level determines if the constructs or items of the instrument is accepted or rejected from the group consensus by experts of the study. Once the alpha-cut level is identified, the aggregate fuzzy evaluation will be determined by adding all fuzzy numbers for all experts (mean of,  $m_1$ ,  $m_2$  and  $m_3$ ). According to (Bodjanova, 2006), the alpha cut value has to be not more than 0.5 (> 0.5).

#### *Step 7: Ranking the constructs and items of the instrument*

Based on the defuzification value, the priority of the items of this instrument will be identified through the ranking process.

### **VIII. FINDINGS AND DISCUSSION**

Results are presented below under 3 headings to answer three sub questions in this phase.

What is the design and development model of the screening tool to assess children's symptomatic behavior?

a) What are the suitable constructs of measurement for screening symptomatic behaviours by children based on experts consensus?

It is interesting to note that, four constructs out of five constructs proposed is accepted. Referring to the first rule in FDM, construct of sensory and motor development, language and communication, social and emotional and cognitive have consensus among the experts with threshold value score below than 0.2. Whereas the construct creativity had a value score above 0.2. Based on experts view, the threshold value, "d" was calculated for all the constructs to determine the consensus level among experts for each constructs. Constructs creativity which exceeded the value of 0.2, indicates the individual experts views for the particular construct are not in consensus with other expert participants (Ching H. C & Yin L., 2002). Therefore the construct creativity was rejected based on experts consensus. However, the calculation of the threshold value is performed overall for the questionnaire items. The second rule of FDM is percentage consensus of experts must be more than 75 %. The construct sensory and motor development, language and communication, social and emotional and cognitive have gained 100% of group consensus from the experts. However the construct creativity alone was rejected based on the calculated percentage of 66.67% of group consensus. The third rule of FDM is the fuzzy score (A) Average of fuzzy number of each construct must be  $\alpha - cut = 0.5$  (Bodjanova, 2006). The average fuzzy number is calculated to determine the ranking and it is not applicable for this section. In response to this rule, the constructs creativity was still rejected even though the fuzzy score value is more than 0.5. The reason emerged is, in order for the construct to be accepted it has to meet the criteria set for all the three rules in FDM. Apparently only one rule is accepted. Moreover, ranking is not needed in this section. Therefore the construct of creativity is rejected to form SymBest. Table 2 below shows the threshold value and group consensus percentage value.

b) What are the suitable items in the main constructs for screening symptomatic behaviours of children based on expert's consensus?

The findings of this question will be explained according to the constructs.

*Construct 1: Sensory & Motor Development.*

Precisely to meet the first rule in FDM, there are 13 items under the construct of sensory and motor development have consensus among the experts with threshold value score below than 0.2. Whereas 17 items were reported to have a threshold value above 0.2. This indicates the individual experts views for the particular items are not in consensus with other expert participants (Cheng & Lin, 2002). The second rule of FDM is percentage consensus of experts must be more than 75%. 13 items under the construct sensory and motor development have gained group consensus more than 75%. However 17 items from the total proposed items was rejected based on the calculated percentage of below than 75%.

*Construct 2: : Language and Communication Development*

In this section, 12 items under the construct of language and communication development have consensus among the experts with threshold value score below than 0.2 and 13 items with threshold value above 0.2. The second rule of FDM is percentage consensus of experts must be more than 75%. 12 items under the construct language and communication development have gained group consensus more than 75%. However 13 items was rejected based on the calculated percentage of below than 75%.

*Construct 3: Social and Emotional Development.*

In this section 17 items under the construct of social and emotional development have consensus among the experts with threshold value score below than 0.2 and 11 items were rejected based on the threshold value above 0.2. The second rule of FDM is percentage consensus of experts must be more than 75%. 17 items under the construct of language and communication development have gained group consensus more than 75%. However 11 items was also rejected based on the calculated percentage of below than 75%.

*Construct 4 : Cognitive Development*

In the section the items under the construct cognitive development was analysed. 9 items under the construct of cognitive development have consensus among the experts with threshold value score below than 0.2 and 9 items were rejected. The second rule of FDM is percentage consensus of experts must be more than 75%. 9 items under the construct language and communication development have gained group consensus more than 75%. However 9 items proposed was rejected based on the calculated percentage of below than 75%.

*Construct 5: Creative Development*

The constructs and items of creativity will be dropped in the formation of SymBest. As explained in the first sub research question, construct creativity was rejected based on the calculated percentage of 66.67% of group consensus. The analysis of the items representing the creativity shows only 4 items selected out of 11 questions proposed. Since the construct itself was rejected and the number of items accepted was low based on experts consensus, creativity development will be eliminated from SymBest.

c) What are the sequence priority of the items in each sections in the screening tool based on experts consensus?

The third rule of FDM is the fuzzy score (A). Average of fuzzy number of each construct must be  $\alpha - \text{cut} = 0.5$  (Bodjanova, 2006). The average fuzzy number is calculated to determine the ranking of the items. The rank of the items are arranged based on the fuzzy scores. In response to this rule, Table 3, 4, 5 and 6 shows the accepted items under the construct sensory and motor development, language

and communication development, social and emotional development and cognitive in ranking with fuzzy scores above 0.5.

Table 2: Experts Group Consensus Percentage.

No	Construct	Triangular Fuzzy Numbers		Defuzzification Process				Expert Consensus	Constructs ACCEPTED
		Threshold Value, d	Experts Group Consensus Percentage, %	m1	m2	m3	Score Fuzzy (A)		
1	Sensory and Motor Development	0.139	100.00%	0.778	0.917	0.978	0.891	ACCEPTED	0.891
2	Language & Communication	0.121	100.00%	0.778	0.922	0.983	0.894	ACCEPTED	0.894
3	Social & Emotional	0.119	100.00%	0.767	0.917	0.983	0.889	ACCEPTED	0.889
4	Cognitive	0.174	100.00%	0.689	0.85	0.956	0.831	ACCEPTED	0.831
5	Creativity	0.214	66.67%	0.578	0.756	0.894	0.743	REJECTED	

Table 3: Items ranking under the construct of sensory and motor development.

Fuzzy Score	Ranking	Items
0.837	1	Found restless with hands and feet.
0.831	2	Avoid activities getting hand and feet messy(finger painting, play dough)
0.828	3	Show repetitive movements (rocking, or repeated speech)
0.806	4	Fall/ crash on the floor throughout the day.
0.804	5	Focus visually on task
0.798	6	Walks on toes
0.794	7	Found over active or on the go more than other children (Jumps/ run/ climb)
0.794	8	Sustain attention in activities
0.793	9	Respond to name call
0.78	10	Easily distracted
0.759	11	Pay attention to the surrounding
0.754	12	Fixed in certain objects, activities or topics
0.743	13	Respond to and follow instructions presented verbally

Table 4: Items ranking under the construct of language and communication development.

<b>Fuzzy Score(A)</b>	<b>Ranking</b>	<b>Language &amp; Communication Development</b>
0.859	1	Say what he/she wants.
0.844	2	Follow simple one commands (come,sit,go,take)
0.837	3	To respond verbal or non verbal to “yes “ or “no”
0.809	4	Join group activity
0.793	5	Communicate easily with other children and adults
0.787	6	Understand what is said to her/him
0.78	7	Pay attention to a short story and answers simple questions about it.
0.746	8	Enjoy looking at books and others stories
0.744	9	Use colour, number and time related words, for example, 'red' car, 'three' fingers and 'yesterday / tomorrow'.
0.726	10	Have poor vocabulary
0.707	11	Greet
0.696	12	Describe recent events, such as morning routines

Table 5: Items ranking under the construct of social and emotional development.

<b>Fuzzy Score (A)</b>	<b>Ranking</b>	<b>Social &amp; Emotional Development</b>
0.942	1	Initiate to make friends.
0.857	2	Injure self while being angry (head banging, biting own self)
0.844	3	Show interest in playing toys.
0.837	4	Show appropriate facial expressions.
0.837	5	Engage in pretend play.
0.824	6	Injure others ( kicking, hitting, biting, pushing)
0.82	7	Prefer to be left alone.
0.819	8	Have eye contact
0.815	9	Wait for turns
0.806	10	Play toys in typical way.
0.794	11	Scream a lot more than other children
0.794	12	Destroy others property
0.793	13	Throw things on others in anger
0.793	14	Destroy things in the classroom (wall charts, furniture)
0.798	15	Cry or scream as a respond to “no” or “stop” command
0.763	16	Destroy own properties
0.717	17	Snatch things from others (toys , food)

Table 6: Items ranking under the construct of cognitive development.

Fuzzy Score (A)	Ranking	Cognitive Development
0.796	1	Know own name
0.793	2	Know what common objects are used for
0.791	3	Uses objects and materials to build or construct things, e.g. block tower, puzzle, clay, sand.
0.785	4	Organize objects by size
0.77	5	Organize objects by shape
0.769	6	Correctly name at least four colors and three shapes
0.761	7	Have a longer attention span of around 5 to 15 minutes
0.735	8	Know own age
0.719	9	Recognize some letters

#### IX. SYMBEST VISUAL LAYOUT USING THE WEB APPLICATION APPROACH.

To facilitate the ECE educators to use SymBest more easily and efficiently, it is made into a fully featured web app with several functions like instant scoring upon completion, scores interpretation for each constructs, overall interpretation, constructs and items in dual languages ( English language and Bahasa Melayu) and saving the report in the PDF file. It is swift and user-friendly because it is optimised for mobile and personal computer users with Andriod, IOS and PC operating system. Any user with internet connectivity can access to SymBest anywhere in no time. The application only stores the information locally in device and will be erased upon the next usage. A brief and simple screening tool will motivate educators to practice screening (Slentz et al., 2008) besides gaining an understanding of the screened child’s behaviours. Javascript, HTML and CSS was used as the programing language for SymBest. Javacript is light weight and provides an easy way to create interactive web pages smoothly. It is preferred for SymBest because of its compatibility with all the major operating systems. HTML was used to add context and texture to the text. Whereas as for the layout, colors, font and section separation, CSS was used. The interface is built using the Vue.js framework with Web pack set up allowed a nice organizational structure of the files or section in SymBest. This application is also optimized for mobile screens and touch inputs.

#### X. DISCUSSION AND CONCLISION

The article has discussed the early identification practices in Malaysia currently and the role of early childhood educators on screening as well as the challenges educators face for early identification in the educational setting. It is very important to identify which children may need intensive and targeted supports for referral completion (Jennings 2012). Based on the Fuzzy Delphi results, findings shows that the constructs of sensory and motor development, language and communication

development, social and emotional development and cognitive development is suitable as a measurement construct for SymBest. The items accepted under each constructs based on experts group consensus is fairly representing children's symptomatic behaviors. There is a need to identify children at-risk of developmental delays as early as 3 to 4 years old or earlier and a screening tool is vital in the early education system. The uniqueness of SymBest compared to other available screening tools are the presence of child developmental domains as constructs and the red-flags of milestones as the measuring items. The red-flags, which is termed as symptomatic behaviours in this study, are placed under each construct as a guide for educators to recognize behaviours at-risk of delays. As been rule out in the problem statement, developmental screening is not practiced in the Malaysian education system, specifically on early identification of symptomatic behaviours as the Ministry of Health shoulders it by itself. Since screening is merely for recognizing the symptoms of delays, surely it is not a formal diagnosis. Therefore screening children for developmental delays in the early childhood education centers are acceptable to guide educators for referrals. In line with this, SymBest's features with developmental domains as constructs and red flags as items have met the purpose of early identification in the early childhood education system. The items in each construct are specifically for the developmental age of 3 to 4 years old. Aside from this, SymBest has a particular element that the tool must be only used after a minimum familiarization period of 3 months with the identified child. Ratings interpreted with any shorter familiarization period will be invalid. Thus, is it a sure thing to say that SymBest additional features, are not included in any other screening tools available in MOE. The availability of SymBest will revoke ECE educator's perception on addressing children's behavioral problems ethically and professionally.

## REFERENCES

- [1] Atwater, J. B., Carta, J. J., Schwartz, I. S., & McConnell, S. R. (1994). Blending Developmentally Appropriate Practice and Early Childhood Special Education. In B. L. Mallory & R. S. New (Eds.), *Diversity & Developmentally Appropriate Practices*. New York: Teachers College Press.
- [2] Balaj, A., Albu, M., Porumb, M., & Miclea, M. (2011). The standardization of Early Childhood Inventory-4 (ECI-4). *Cognition, Brain, Behavior: An Interdisciplinary Journal*, 15(1), 95–110.
- [3] Bayat, M. (2015). *Addressing Challenging Behaviors and Mental Health Issues in Early Childhood* (1st ed.). Routledge.
- [4] Beazidou, E., Botsoglou, K., & Andreou, E. (2013). Classroom behavior management practices in kindergarten classrooms: An observation study. *Hellenic Journal of Research in Education*, 1(1), 93–107. <https://doi.org/10.12681/hjre.8794>
- [5] Blair, S., & UHL, N. P. (1993). Using the Delphi Method to Improve the Curriculum. *The Canadian Journal of Higher Education*, XXIII.
- [6] Bodjanova, S. (2006). Median alpha-levels of a fuzzy number. *Fuzzy Sets and Systems*, 157(7), 879–891. <https://doi.org/10.1016/j.fss.2005.10.015>
- [7] Bowling, K. M., Thompson, M. L., Amaral, M. D., Finnila, C. R., Hiatt, S. M., Engel, K. L., ... Cooper, G. M. (2017). Genomic diagnosis for children with intellectual disability and / or developmental delay. *Genome Medicine*, 9(43), 1–11. <https://doi.org/10.1186/s13073-017-0433-1>
- [8] Child Mind Institute. (2015). *Children's Mental Health Report*. Child Mind Institute. Retrieved from [http://www.speakupforkids.org/ChildrensMentalHealthReport\\_052015.pdf](http://www.speakupforkids.org/ChildrensMentalHealthReport_052015.pdf)
- [9] Ching H. C., & Yin L. (2002). Evaluating the best main battle tank using fuzzy decision. *European Journal of Operational Research*, 142, 174–186.
- [10] Curtis, S. (2011). "Tangible as Tissue": Arnold Gesell, Infant Behavior, and Film Analysis, 24(3), 417–442. <https://doi.org/10.1017/S0269889711000172>
- [11] Davis, S. D., Young, E. L., Hardman, S., & Winters, R. (2011). Screening for Emotional and Behavioral Disorders. *Principal Leadership Archives*, 11(9), 12–18.
- [12] DiStefano, C. S., & Kamphaus, R. W. (2007). Development and validation of a behavioral screener for preschool-age children. *Journal of Emotional and Behavioral Disorders*, 15(2), 93–102. <https://doi.org/10.1177/10634266070150020401>

- [13] Edwards, M. D. (2009). *Identifying At Risk Young Children: A Comparison Of The Preschool And Kindergarten Behavior Scales, Second Edition And The Behavior Assessment System For Children, Second Edition*. Capella University.
- [14] Eklund, K., Renshaw, T. L., Dowdy, E., Jimerson, S. R., Hart, S. R., Jones, C. N., & Earhart, J. (2009). Early Identification of Behavioral and Emotional Problems in Youth: Universal Screening versus Teacher-Referral Identification. *California School Psychologist*, 14, 89–95. <https://doi.org/10.1007/BF03340954>
- [15] Gesell, A. (1925). *The Mental Growth of Preschool Child*. New York: The Macmillan Company.
- [16] Gesell, A. (1928). *Infancy and Human Growth*. Toronto: The Macmillan Company.
- [17] Guddemi, M., Sambrook, A., Wells, S., Randel, B., Fite, K., Selva, G., & Gagnon, K. (2014). Arnold Gesell's Developmental Assessment Revalidation Substantiates Child-Oriented Curriculum. *SAGE Open*, (April-June), 1–18. <https://doi.org/10.1177/2158244014528918>
- [18] Guralnick, M. J. (2017). Early Intervention for Children with Intellectual Disabilities: An Update. *Journal of Applied Research in Intellectual Disabilities*, 30, 211–229.
- [19] Haniz Ibrahim, Siti Eshah Mokshein, Ardzulyana Anal, & Syamsinar Abd Jabar. (2014). Assessment for children with special educational needs. *Jurnal Pendidikan Bitara UPSI*, 7, 9–15.
- [20] IDEA. (2004). *Individuals With Disabilities Education Improvement Act of 2004*.
- [21] Jennings, D. J. (2012). *Early Childhood Developmental Screening: Predictors of Screening Referral Completion*. The Florida State University.
- [22] Kaiser, B., & Rasminsky, J. S. (2009). *Challenging Behavior in Elementary and Middle School (1st Editio)*. Pearson International Edition.
- [23] Kauffman, J. M., & Landrum, T. J. (2012). *Charetieristics of Emotional and Behavioral Disorders of Children and Youth (10th ed.)*. Pearson International Edition.
- [24] Mueller, U., & Eycke, K. Ten. (2014). Piagetian Theory Self-Organization. *Encyclopedia of Science Education*, (1988), 1–11. <https://doi.org/10.1007/978-94-007-6165-0>
- [25] National Association for the Education of Young Children (NAEYC). (2009). *12 Principles of Developmentally Appropriate*. Retrieved from <https://www.naeyc.org/>
- [26] Nelson, B. B., Dudovitz, R. N., Coker, T. R., & Elizabeth, S. (2016). Predictors of Poor School Readiness in Children Without Developmental Delay at Age 2. *Pediatrics*, 138(2).
- [27] Pao-Long. C, Chiung. W.H, & Po-Chien. C. (2011). Fuzzy Delphi method for evaluating hydrogen production technologies. *International Journal of Hydrogen Energy*, 36(21), 14172–14179. <https://doi.org/10.1016/j.ijhydene.2011.05.045>
- [28] Pao-long Chang, & Chiung-Wen Hsu. (2011). Fuzzy Delphi Approach for Evaluating Hydrogen Fuel Cell. *2nd International Conference on Education and Management Technology*, 13, 133–138.
- [29] Parritz, R. H., & Troy, M. F. (2014). *Disorders Of Childhood: Development and Psychopathology (2nd Editio)*. United States of America: Jon-David Hague.
- [30] Polanczyk, G. V., Salum, G. A., Sugaya, L. S., Caye, A., & Rohde, L. A. (2015). Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 56(3), 345–365. <https://doi.org/10.1111/jcpp.12381>
- [31] Poulou, M. S. (2015). Emotional and Behavioural Difficulties in Preschool. *Journal of Child and Family Studies*, 24(2), 225–236. <https://doi.org/10.1007/s10826-013-9828-9>
- [32] Purpura, D. J., & Lonigan, C. J. (2009). Conners' Teacher Rating Scale for preschool children: a revised, brief, age-specific measure. *Journal of Clinical Child and Adolescent Psychology*, 38(2), 263–72. <https://doi.org/10.1080/15374410802698446>
- [33] Ramesh C. Mishra. (2014). Piagetian Studies of Cognitive Development in India. *Psychology Study*, 59(September), 207–222. <https://doi.org/10.1007/s12646-014-0237-y>

- [34] Robinson, M., & Dunsmuir, S. (2010). Multi-professional assessment and intervention of children with Special Educational Needs in their early years: The contribution of educational psychology. *Educational & Child Psychology*, 27(4).
- [35] Schepers, S., Dekovi, M., & Feltzer, M. (2012). Drawings of very preterm-born children at 5 years of age: a first impression of cognitive and motor development? *European Journal of Pediatric*, 171, 43–50. <https://doi.org/10.1007/s00431-011-1476-8>
- [36] Studts, C. R., & Van Zyl, M. A. (2013). Identification of developmentally appropriate screening items for disruptive behavior problems in preschoolers. *Journal of Abnormal Child Psychology*, 41(6), 851–863. <https://doi.org/10.1007/s10802-013-9738-8>
- [37] Thelen, E., & Adolph, K. E. (1992). Arnold L. Gesell: The Paradox of Nature and Nurture. *Developmental Psychology*, 28(3), 368–380. <https://doi.org/10.1037/0012-1649.28.3.368>
- [38] Thomaidis, N. S., Nikitakos, N., & Dounias, G. (2006). The Evaluation of Information Technology Projects: a Fuzzy Multicriteria Decision-Making Approach. *International Journal of Information Technology & Decision Making*, 05(01), 89–122. <https://doi.org/10.1142/S0219622006001897>
- [39] Valla, L., Wentzel-larsen, T., Hofoss, D., & Slinning, K. (2015). Prevalence of suspected developmental delays in early infancy: results from a regional population-based longitudinal study. *BMC Pediatrics*, 15(215), 1–8. <https://doi.org/10.1186/s12887-015-0528-z>
- [40] Weitzman, C., & Wegner, L. (2015). Promoting Optimal Development: Screening for Behavioral and Emotional Problems. *Journal of the American Academy of Pediatrics*, 135(2). <https://doi.org/10.1542/peds.2014-3716>
- [41] Wicks-Nelson, R., & Israel, A. C. (2006). *Behavior Disorders Of Childhood* (6th ed.). Pearson International Edition.