

## Validation of a child emotional learning activity kit using the fuzzy Delphi technique

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### Article Info

#### Article history:

Received May 16, 2025

Revised Apr 6, 2026

Accepted May 23, 2026

#### Keywords:

Fuzzy Delphi

Home learning

Learning kit

Preschool education

Socio-emotional development

### ABSTRACT

Early childhood is a critical period for socio-emotional development, yet parents often lack structured tools to reinforce these skills at home. The study aims to obtain the experts' unanimous agreement on the contents and components of an emotional learning activity kit for children. This study used the fuzzy Delphi method (FDM) to gather feedback from 13 experts in early childhood education. The survey contained 27 items, which used the seven-point Likert scale. FDM data was analyzed using triangular fuzzy numbers (TFN). The results of the study demonstrated consensus of the construct is at a high level. The overall expert consensus agreement exceeds 75%, the overall value of the threshold ( $d$ ) is 0.2, and the  $\alpha$ -cut exceeds 0.5. The value of the learning contents showed that the expert agreement of this kit is highly acceptable. Findings also showed learning material in this kit has a high agreement value, and it can be used to empower teachers and parents to cultivate their children's emotional learning, bridging the gap between curriculum and home-based learning. Future research should consider expanding the application of this emotional learning activity to children in preschool.

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## 1. INTRODUCTION

Early childhood is a foundational period for establishing socio-emotional competencies that significantly influence long-term academic skills and achievement. Emotional development plays a vital role in preparing children mentally to face challenges in their environment, fostering resilience and strong character, and helping them develop self-regulation skills [1], [2]. Children who experience emotional and behavioral difficulties are at increased risk of facing future challenges that may impact their daily functioning, mental health, and behavior, potentially hindering their academic progress [3], [4]. Despite the importance of this issue, recent research reveals that 5%–15% of children experience early-onset emotional and behavioral difficulties, risking them for future mental health and academic challenges [5], [6].

Emotional development is emphasized through the implementation and exposure to emotional learning experiences [7], without separating social development from emotional development, as both are closely interconnected. These aspects are crucial and have a significant influence on their later lives, including as key predictors of future success in academic, work, and social success [8]. Social emotional learning (SEL) is the process by which children acquire knowledge, skills, and attitudes to manage emotions, set positive goals, feel empathy, establish social relationships, and make responsible decisions [2].

This emphasis is also aligned with the SEL framework introduced by the Collaborative for Academic, Social, and Emotional Learning (CASEL), which outlines five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making [9], [10]. Recognizing this vital developmental window, the 2026 preschool curriculum (KP2026) focuses on socio-emotional development as one out of six key learning areas, which highlights core competencies such as self-development, multiliteracy, and communication, including the ability to articulate personal feelings, express viewpoints, and interact meaningfully about culture in the context of daily life.

In Malaysia, effective parental involvement in education is highlighted by national initiatives, including the Twelfth Malaysia Plan, which aligns directly with education for sustainable development (ESD), acting as a bridge between classroom learning and home learning. Through formal training, preschool teachers are well-equipped to foster these emotional competencies within supportive classrooms. However, in order for the learning to be meaningful, there must be a transferable and continuous learning between the school and home environment [11].

Children nowadays are struggling to handle emotions through environmental pressure, which could affect their behavior in the future. These situations occur because children's understanding and management of emotions are likely influenced by the beliefs and family environment [1] and also the culture shaped by their parents [12]. It is often challenging for parents to actively facilitate emotional learning at home, as socio-emotional competencies are abstract and difficult to convey to young children. Time constraints [13] and a lack of pedagogy skills further limit their ability to provide learning experiences at home. Research by [14] highlights the need for support in engaging with their children and in creating a conducive home learning environment.

Past research by [15] stated that studies related to emotion in preschool are associated with school involvement, social adaptation, emotional regulation, and academic achievement, yet less attention has been given to supporting learning at home. To bridge this critical gap, there is an urgent need for a structured, tactile, and engaging emotional learning kit. A well-designed activity kit can translate abstract emotional concepts into concrete play, providing parents with clear strategies and visual aids to nurture children's socio-emotional development.

While some recent educational research [16]–[18] target the development and testing of the emotional module, this study emphasizes the development of the learning emotional kit in Malaysian context, as preschool-aged children benefit from structured learning activities [19]. Therefore, this study aims to systematically design and develop an emotional learning activity kit using the fuzzy Delphi method (FDM) to obtain expert consensus on the learning contents and physical components for the learning kit. Previous research that used this design in developing learning material for preschoolers, including [20]–[23].

## 2. METHOD

Based on Váradi [2], the design and development research (DDR) is divided into three main phases, which are need analysis, design and development, and evaluation phase. This study represents the second phase—design and development of a learning kit. Specifically, it employs a quantitative approach utilizing the FDM. By integrating fuzzy set theory with traditional Delphi techniques, the FDM effectively translates subjective expert opinions into measurable data, allowing the researchers to establish a reliable consensus on the essential contents of the emotional activity kit. The following are steps for collecting and analyzing the data.

### 2.1. Choosing experts

A purposive sampling technique was utilized to select 13 experts, which falls within the optimal range of 10 to 15 required to ensure high uniformity and reliable measurement [24]. The panel comprised preschool teachers, early childhood education lecturers, and child psychology lecturers. Selection criteria required experts to have a relevant academic background and more than five years of practical experience in their respective fields, ensuring they could critically evaluate the kit's developmental appropriateness. Demographic information of the expert is presented in Table 1.

Table 1. Expert's demographic information

Expertise	Level of education				Gender	
	Diploma	Bachelor	Master	Ph.D.	Male	Female
Preschool teachers (early childhood education)			4		2	2
Lecturers and parents (early childhood education)				6	1	5
Lecturers (psychology)	3				1	2
Total	3					

## 2.2. Questionnaire

The survey instrument was developed by synthesizing data from a Phase 1 needs analysis (expert interviews) and an extensive literature review. This process yielded a 27-item questionnaire evaluated on a seven-point Likert scale. To ensure clarity and provide opportunities for immediate clarification, questionnaires were administered through direct, face-to-face meetings with the selected experts.

## 2.3. Changing linguistic variables

The application of triangular fuzzy numbers (TFN) allows experts to interpret constructs and indicators differently based on professional experiences and contextual understanding. In this process, the analysis becomes more systematic and reliable, facilitating the measurement of consensus among experts during the validation process. Furthermore, the result from this process provides a stronger foundation for subsequent analyses, including determination of threshold values, calculating expert agreement percentages, and establishing the defuzzification scores required for decision-making in the module development process.

## 2.4. Data analysis

The threshold (d) value, which identifies when experts have reached agreement, was calculated using TFNs [25]. According to the literature, consensus is achieved when the threshold (d) value is under or equal to 0.2 [26], [27]. In order for the consensus to be accepted, at least 75% of all experts must be in agreement; otherwise, another round of the fuzzy Delphi procedure needs to be carried out. Consequently, the kit is more likely to meet the needs of its target users and achieve the educational objectives in real-world early childhood learning environments.

## 2.5. Percentage value of expert agreement and defuzzification process

The defuzzification process, which is the final step, involving calculation of the defuzzification value for each item in the questionnaire. This step is a comprehensive process for evaluating expert consensus, ensuring a high level of agreement before proceeding with further rounds or finalizing results. Each item's  $\alpha$ -cut value was examined, with values greater than 0.5 indicating consistent and reliable expert judgements [3]. This process enables the systematic identification and prioritization of items based on the degree of expert consensus, providing a robust foundation for the emotional activity kit.

## 2.6. Establishing reliability and validity in fuzzy Delphi method

In this study, reliability was demonstrated when two conditions were met: i) the threshold (d) value  $\leq 0.2$  and ii) the percentage of expert agreement  $\geq 75\%$  [26], [27]. All 27 items in this study satisfied both conditions, confirming that the expert panel's judgements were stable and reproducible. Content validity in this study was ensured by developing items from two sources, which are phase 1 need analysis (expert interviews) and a systematic literature review. Construct validity was determined through the defuzzification process, where all items achieved  $\alpha$ -cut values  $\geq 0.5$ , indicating that experts consistently rated the items as relevant and important [28]. Face validity was addressed through face-to-face meetings, allowing experts to clarify ambiguous items immediately.

## 3. RESULTS AND DISCUSSION

The proposed learning contents and physical components for the children's emotional activity kit were rigorously validated using the FDM with a panel of 13 experts. A total of 18 items across six learning elements (E1–E6) were evaluated. The analysis shows that all items fulfilled the required FDM criteria, with threshold values under 0.2, expert agreement exceeding 75%, and defuzzification scores ranging from 0.938 to 0.967. In the FDM procedure, defuzzification values approaching 1.0 indicate stronger expert consensus, suggesting that the proposed learning contents were highly supported by the expert panel. As summarized in Table 2, the analysis demonstrates that all evaluated items successfully fulfilled the required FDM criteria.

Emphasizing the role of parents' guidance in learning activity reflects Vygotsky's scaffolding perspective and Bandura's social learning theory. These findings established previous research indicating that young children best develop emotional competence, such as recognizing, labelling, and interpreting emotions, through structured guidance and fun interactions with parents. The expert consensus summarized in Table 2 is supported by the theoretical framework and previous studies. Specifically, the validation of each core learning content corresponds directly to findings from previous literature.

Identifying basic emotions (E1): the experts strongly agreed that introducing and explaining fundamental emotions aligns with the work of [29], who suggests that effective emotional learning must stress on helping children recognize feelings and emotions. This foundational step is critical for developing

emotional awareness. Yet, past research [30], [31] emphasizes that this type of emotion may oversimplify and may not be as effective in conveying the emotional states in real-world social interactions. Thus, while E1 provides a foundation for emotional learning, the kit's long-term efficacy may depend on how it scaffolds children towards emotional understanding beyond basic emotion identification. Differentiating situational contexts (E2): guiding children to recognise favourable and unfavourable situations ( $A = 0.967$ ) is vital because classifying emotions remains highly challenging for children if these basic types and their environmental triggers are not clearly identified. A critical perspective drawn from ecological system theory determined that situational contexts are culturally mediated. However, favourable or unfavourable situations may vary significantly across family and cultural settings. This is highlighted by the fact that responsive emotional learning must include diverse contextual scenarios to ensure relevance in children's daily life context. The researcher will consider this element in the development of the kit.

Recognising facial expressions (E3): the kit emphasises introducing different facial expressions for corresponding emotions. This skill is important for children to interpret the intentions of others, adjust their own behavior, and respond suitably in social interactions [8]. This component is supported by [32], whose research demonstrated that the ability to interpret facial expressions enables children to understand the intentions of others, modify their own behaviour, and respond appropriately in early social situations. This learning content is also recognised by [33], who developed a research instrument utilizing cartoon facial expressions to help preschoolers identify emotions. Therefore, learning content E3 represents a valuable learning content for emotional learning.

Navigating social interactions (E4, E5, and E6): the learning kit helps children to distinguish and differentiate the emotions of other individuals based on their behaviour and facial expressions. These contents utilize a variety of emotional skills in order to understand the situations and people around them. It is consistent with other inventions by [23], [34] using DDR approach, which highlighted that a systematically designed and expert-validated product can provide meaningful learning experiences.

Table 2. Summary of expert consensus on the emotional activity kit (contents and physical components)

Construct	No. of items	Threshold value ( $d$ )	Expert agreement (%)	Fuzzy score ( $A_{max}$ )	Decision
Learning contents					
E1: Introduce, explain, and identify types of emotions.	3	0.022–0.071	92.3–100	0.938–0.959	Accepted
E2: Differentiate between favorable and unfavorable situations.	3	0.000–0.040	100	0.951–0.967	Accepted
E3: Recognize facial expressions and name emotions situationally.	3	0.000–0.040	100	0.951–0.967	Accepted
E4: Identify emotions visually from past events/situations.	3	0.022–0.056	92.3–100	0.946–0.959	Accepted
E5: Explain emotions existing in a particular event.	3	0.022	100	0.959	Accepted
E6: Distinguish and differentiate the emotions of other individuals.	3	0.022–0.056	92.3–100	0.946–0.959	Accepted
Physical components					
A digital manual book, the use of magnets, activity names, clear objectives, supported aids, a reward chart, an emotional tracker, suggested time allocations, and step-by-step instructions.	9	0.000–0.022	100	0.959–0.967	Accepted

### 3.1. Cultivating emotional clarity and social awareness

Experts' consensus agreed on six foundational learning contents that systematically progress from internal self-awareness to complex social navigation. The learning progression begins with parents introducing and explaining basic emotions (E1) to broader social contexts, exposing children to identify and differentiate the emotions of others (E5 and E6). Interpreting others' emotions correctly may lead to positive adaptive functioning in society by becoming more compassionate empathy, and lead to a better quality of life in the future.

### 3.2. Integrating tactile play and fine motor development

To successfully operationalise these learning contents, the FDM analysis validated nine physical components: a digital manual book, the use of magnets, activity names, clear objectives, supported aids, a reward chart, an emotional tracker, suggested time allocations, and step-by-step instructions. By utilizing a hand-carry size, the kit naturally merges abstract emotional learning with concrete fine motor activity. The repetitive movement of hand activities, including grasping, orienting, and placing these magnets organically refines a child's pincer grasp and fine motor precision. Besides, the navigation of the reward chart and emotional tracker along the activity stimulates visual-motor integration and spatial organisation. This tactile

engagement enhances the learning process, allowing children and parents to actively practice self-reflection before and after activities, thereby transforming complex socio-emotional concepts into interactive, multisensory experiences.

#### 4. CONCLUSION

The rigorous expert validation of this emotional activity kit ensures parents have access to highly engaging, developmentally appropriate learning materials for preschool-aged children. By interacting with the tactile kit, children learn to accurately identify complex emotions, adapt their emotional responses across diverse situations, and articulate their internal states based on past experiences, successfully bridging the crucial gap between formal preschool education and home-based support. Despite these contributions, the study acknowledges certain limitations. The expert validation process may introduce cultural biases, and the findings currently possess limited generalizability beyond the home context. Future research must explore extensive field testing with diverse families and children, including with special needs, to ensure the kit is inclusive and culturally responsive. This study suggests exploring the advancement of digital adaptations and the longitudinal impact of the kit on the socioemotional development of children. Despite home use, teachers may incorporate this kit into preschool routines to encourage social interaction, while therapists may use this kit to assist children to safely express feelings, practice coping skills, and effectively resolve conflicts.

#### ACKNOWLEDGMENTS

The authors extend their sincere gratitude to the Universiti Pendidikan Sultan Idris for the opportunity and resources provided to conduct this study. Our deep appreciation to the 13 dedicated experts involving preschool teachers and lecturers, who generously served on our FDM evaluation panel. Informed consent has been explicitly obtained from all individuals acknowledged here for their personal assistance and contributions.

#### FUNDING INFORMATION

This research has been carried out under the Research Grants University Scheme 2021-0056-107-01 (GGPU) provided by the Universiti Pendidikan Sultan Idris. Therefore, we would like to give our gratitude to Universiti Pendidikan Sultan Idris for the funds and opportunity given to us in doing this research.

#### AUTHOR CONTRIBUTIONS STATEMENT

This study uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

#### CONFLICT OF INTEREST

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## ETHICAL APPROVAL

This study adhered to ethical standards for research involving minors. Informed consent was obtained from all the participants who involved in this research. Anonymity and confidentiality were strictly maintained, and all activities were carefully designed to ensure the safety and well-being of the children.




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