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ANALYSIS OF THE NEEDS FOR DEVELOPMENT OF THE BRICKSMART HYBRID DIGITAL NUMBER SKILLS MODULE IN IMPROVING THE THINKING SKILLS OF PRESCHOOL CHILDREN

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Abstract:

In design and development research, the most critical phase is the needs analysis. In this study, a needs analysis was conducted to ensure that the developed module effectively met users' requirements. This quantitative survey study was carried out to examine the need for developing the hybrid digital number skills module, BrickSmart. It examines enhancements in preschool children's thinking skills from teachers' perspectives, as well as teachers' perceptions and knowledge regarding the use of instructional support materials as thinking tools that are not yet widely implemented at the preschool level. The study focuses on developing an innovative intervention in early childhood education, particularly by integrating digital technology with a virtual brick-based learning approach for early mathematics instruction. These skills encompass pre-number skills, number concepts, and basic number operations based on the cognitive learning domain outlined in the Kurikulum Prasekolah 2026 (KP 2026). A set of needs analysis questionnaires was administered to 50 primary school mathematics teachers in a district in the state of Penang, Malaysia. The data obtained were analysed descriptively using statistical software to calculate frequencies and percentages. The findings revealed that the majority of respondents agreed that the module is appropriate for students' learning.

Specifically, 87.6% of respondents indicated that developing an interactive digital learning module is necessary for the number skills learning domain and for fostering preschool children's thinking skills. In addition, the results showed that teachers possess knowledge of the Learning Standards (Standard Pembelajaran), with 66.9% of respondents applying various pedagogical approaches to fulfil the cognitive learning standards during teaching and learning (PdPc) sessions. However, only 59.4% of respondents reported using digital support materials and thinking tools during classroom instruction. Overall, the findings provide a preliminary overview of the need for implementing the hybrid digital number skills module, BrickSmart, to enhance preschool children's thinking skills.

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Keyword:

Digital Module, Design and Development Research, Needs Analysis, Number Skills, Preschool



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Introduction

Number skills are one of the learning standards within the early mathematics discipline, as outlined in Kurikulum Prasekolah 2026 (KP 2026). Early mathematics is defined as focusing on pre-number concepts, fundamental number understanding, number operations, measurement, comparison, time, and spatial awareness, to be taught in accordance with children's developmental stages (Farhana, 2021). Meanwhile, the concept of number refers to the quantity present in a set, which can be represented as numerals or symbols (Liu et al., 2024).

At the preschool learning stage, every child has the potential to master number skills and, through ongoing educational transformation, to develop global thinking competencies. Malaysia is rapidly advancing in the era of globalisation and is striving to achieve world-class educational standards (Aqil, 2024). Since 2014, the Ministry of Education Malaysia has introduced 21st Century Learning (PAK-21) as an initiative to elevate the national education system to global benchmarks. PAK-21 emphasises student- and resource-centred learning approaches (Jerry et al., 2021). This initiative continues to be strengthened through the introduction of self-competencies in Thinking Skills within the new preschool curriculum, KP 2026. Importantly, Thinking Skills represent a crucial aspect advocated in KP2026, where creative and critical elements serve as key drivers in cultivating PAK-21 competencies among preschool children.

The importance of mastering number concepts enables preschool children to apply these skills in routine number operations and problem-solving (Nur Amira, 2018). In particular, early acquisition of number skills is among the key components in the development of analytical, creative, and critical thinking abilities, particularly for children aged five and six during their

preschool and kindergarten years (Aina, 2021). The integration of number skills mastery with PAK-21 thinking competencies aligns with the aspirations of the Kurikulum Persekolahan 2027 (KP 2027) framework, which explicitly integrates knowledge, skills, and values. This alignment, in turn, responds to policy demands outlined in the Pelan Pembangunan Pendidikan Malaysia (PPPM) 2026–2036 and contemporary educational needs. Support for this emphasis is evident in field research conducted by Zazali S. and Nasir N.M. (2022), which highlighted that the core concepts advocated in the preschool curriculum aim to enhance children's cognitive development by fostering critical and analytical thinking.

Nearly 16 years (from 2010 to the present) have passed since the Ministry of Education Malaysia mandated the implementation of the national preschool curriculum for the teaching and learning of number skills. Nonetheless, persistent issues related to mathematical skills remain unresolved (Nur Amira, 2018; Aina, 2021). Issues concerning achievement and mastery in mathematics are evergreen, as they continue to be discussed, debated, and examined through ongoing research.

Therefore, research related to the development of digital learning materials, particularly for preschool children, should be advanced in line with the current digitalisation era. Teachers and children should be provided with access to applications or digital learning resources that ensure continuity of learning between school and home through sustained virtual engagement (Emma et al., 2024). As demonstrated by Conny et al. (2021) in their study on the use of number books in early mathematics instruction for preschool children, further research is also recommended to provide opportunities for children to learn mathematical skills through digital learning materials.

Accordingly, research on the development of interactive digital modules integrated with concrete teaching aids through hybrid learning approaches is highly relevant, especially for number skills learning that involves pre-number skills, number concepts, and basic mathematical operations among preschool children. The development of such modules is deemed particularly relevant and may serve as a practical guide for teachers and parents in facilitating learning both in school and at home. Moreover, interactive digital modules grounded in number skills content are essential for enhancing children's knowledge and fostering the development of PAK-21 competencies to support their cognitive growth (Juppri et al., 2019). Strong numeracy knowledge and skills can help children maximise their cognitive potential and, subsequently, contribute positively to the development of their 21st-century thinking capabilities.

Nonetheless, to develop a module that effectively meets learners' needs, a needs analysis must first be conducted to identify requirements for modules targeting number and thinking skills among preschool children. This includes examining teachers' knowledge of module utilisation and pedagogical approaches that incorporate technology-integrated learning support materials. Thus, this study was undertaken to fulfil these objectives. Furthermore, given the limited research on technology integration in the development of learning support materials for number skills topics and thinking tools at the preschool level, this study also explores teachers' views and knowledge regarding such technological integration across both skill domains.

The objectives of the study are as follows:

- (1) To identify the need for developing the Hybrid Digital Number Skills Module (HybriBrickSmart) in enhancing preschool children's thinking skills from the perspectives of preschool teachers; and
- (2) To identify teachers' knowledge and perceptions regarding the integration of technology in the development of learning support materials for preschool children's number skills and thinking skills.

Methodology

Research Design

The study employed a quantitative research approach using a cross-sectional survey design, a commonly utilised method in needs analysis studies. In this research, the cross-sectional survey collected data at a single point in time throughout the study period. Additionally, a needs analysis can be conducted using direct or indirect client feedback to identify existing problems and predict potential solutions to meet clients' future needs (Albaree, 2022). In this study, the term client refers to teachers in the field of early childhood education who are serving in preschool settings.

This method provides quantitative or numerical descriptions of trends, attitudes, or opinions within a population by examining a representative sample of that population (Creswell, 2009). A questionnaire survey was used as the primary instrument to collect data from the respondents.

Research Sample

The sample selected for this study comprised preschool teachers from a district in the state of Pulau Pinang. The sampling technique employed in this first phase was purposive sampling. This method was chosen for its suitability and practicality in obtaining feedback and perspectives from respondents most relevant to the study's objectives. According to Othman (2018), individuals considered experts should have more than 5 years of professional experience. They should also hold at least a master's degree, demonstrate competency in teaching at the preschool level, and be actively involved in early childhood education.

Accordingly, the researcher targeted 50 preschool teachers teaching within the same district for the distribution of an online questionnaire. The rationale for selecting respondents from the same district was to ensure sample homogeneity. Ashley Crossman (2020) stated that homogeneous purposive sampling refers to selecting participants who share similar characteristics. Thus, the justification for employing this method aligns with the required criteria, as all respondents were early childhood education teachers serving in preschool settings. Only preschool teachers were considered capable of providing appropriate insights and accurate feedback on the need to develop the Hybrid Digital Number Skills Module, BrickSmart, to enhance preschool children's thinking skills.

Furthermore, simple random sampling was utilised to select the study participants. A total of 50 preschool teachers voluntarily participated in the study by completing an online questionnaire developed using Google Forms. The questionnaire was distributed via WhatsApp

and email using preschool teacher contact information obtained from the Preschool Unit of the Penang State Education Department.

Research Instruments

This study utilised a set of questionnaires administered to preschool teachers during Phase 1 (needs analysis). The questionnaire instrument was adapted from previous studies by Syar Meezee (2021), Salleh et al. (2023), Albaree (2022), and Mohd Ridhuan (2016). The developed instrument underwent content and language validation by selected experts from relevant fields, including mathematics education and early childhood education. The questionnaire consisted of two main sections. Section A focused on respondents' demographic information, while Section B aimed to identify the need for developing the Hybrid Digital Number Skills Module, BrickSmart, to enhance preschool children's thinking skills. To achieve this objective, respondents were required to indicate their level of agreement using a five-point Likert scale, as presented in Table 1.

Table 1 A Five-point Likert Scale

Scale	Level of Agreement
1	Strongly Disagree
2	Disagree
3	Moderately Agree
4	Agree
5	Strongly Agree

Instruments Validity

Upon completion of the instrument development, three subject-matter experts were appointed to evaluate the questionnaire's validity, as recommended by Nunnally (1978). In this study, three validators were selected to establish the validity of the constructed instrument.

The panel of experts comprised specialists in relevant fields, including an early childhood education lecturer, a lecturer from the Institute of Teacher Education (IPG) representing the Department of Planning, Research, and Innovation, and a mathematics lecturer from the IPG Pulau Pinang Campus. Following the validation process, the instrument was analysed and refined based on the experts' comments and recommendations, as presented in Table 2.

Table 2 Comments and Suggestions

<i>Experts</i>	<i>Comments and Suggestions</i>
<i>Expert 1</i>	Overall, the instrument is well-developed and appropriate. However, several items were identified as repetitive (refer to the instrument). The expert suggested that: (i) Items related to number skills should be clearly focused and specified by labelling them according to pre-number skills, number concepts, or basic mathematical operations (refer to Items 8–17); and (ii) Overlapping content was observed in Items 18–20. These items should be improved by incorporating more specific, content-based questions to better assess the learning support materials.

Expert 2	The research instrument developed is highly satisfactory and relevant to the study objectives. The ideas presented are original, demonstrate strong validity, and the language used is appropriate and systematically organised. The module is considered highly suitable for future implementation.
Expert 3	The questionnaire items are clear and easy to understand. It is recommended to present percentage breakdowns rather than using the term “overall” when evaluating the Learning Standards (Standar Pembelajaran).

Subsequently, to determine the level of agreement regarding face validity and content validity among the experts, the Content Validity Index (CVI) was employed. For newly developed instruments, the acceptable CVI value is ≥ 0.78 when evaluated by three experts, which represents the minimum acceptable threshold for content validity (Polit & Beck, 2006).

The content validity analysis using CVI values from the three experts was conducted according to the following criteria: items rated as appropriate received a value of 1.00, items rated as needing improvement received a value of 0.67, and items rated as inappropriate received a value of 0.33. In this study, the CVI was calculated using the following formula, and the resulting CVI values were recorded as presented in Table 3.

$$\text{Content Validity Index (CVI)} = \frac{\text{Total Score Assigned by Experts}}{\text{Total Possible Score}},$$

$$\text{Item Level Content Validity Index (I - CVI)} = \frac{\text{Number of Experts Agreeing on the Item}}{\text{Total Number of Experts}}.$$

Table 3 Content Validity (CVI)

Construct	Item	Expert 1	Expert 2	Expert 3	I-CVI
Face Validity	1	1	1	1	1
	2	1	1	1	1
	3	1	1	1	1
	4	1	1	1	1
	5	1	1	1	1
	6	0	1	1	0.67
	7	1	1	1	1
Total CVI		0.85	1	1	0.95
Content Validity	8	1	1	1	1
	9	1	0	1	0.67
	10	1	1	1	1
Total CVI		1	0.67	1	0.89

The average I-CVI for face validity was 0.95, while the average I-CVI for content validity was 0.89. These findings indicate that the CVI values for each construct met the acceptable threshold of $\text{CVI} \geq 0.8$, as recommended by Davis (1992). Nevertheless, Items 6 and 9 received

an I-CVI of 0.67. These items were accepted but subsequently revised in line with the experts' recommendations to improve clarity and relevance. After ensuring the questionnaire was suitable for use through second screening and item rewriting, the instrument was distributed to respondents via WhatsApp and email.

Pilot Study

To ensure the questionnaire's suitability, clarity, and functionality, a pilot study was conducted prior to actual data collection. The pilot study involved 30 preschool teachers selected from a list compiled by the State Education Department and the District Education Office in a northern state of Malaysia. The purpose of the pilot study was to evaluate respondents' understanding of the questionnaire items, examine the instrument's overall structure, and identify any technical issues in the questionnaire that required refinement before implementing the actual study procedures.

The questionnaire was developed using the Google Forms platform, and the pilot study link was distributed via WhatsApp and email to facilitate respondents' accessibility. Feedback from the 30 respondents was analysed to assess the clarity of the items, determine preliminary reliability levels, and identify areas requiring improvement prior to the full-scale distribution.

Following revisions based on the pilot study findings, the actual data collection was carried out involving 50 preschool teachers who met the study population criteria. The final questionnaire link was also distributed via WhatsApp and email using the same approach. From an ethical perspective, all respondents were provided with preliminary information about the study's purpose, their right to withdraw at any time, and assurances of confidentiality and anonymity for the information they provided. Respondents' informed consent was obtained digitally before they commenced the questionnaire. The study also adhered to principles of data protection and confidentiality, in line with Data Security and Responsibility (DSAR) practices, ensuring that all data were stored on secure platforms and used solely for research purposes.

Data Analysis

The survey findings were based on quantitative data. The data analysis process for the needs analysis phase was conducted using the *Statistical Package for the Social Sciences (SPSS)* version 26.0. Data analysis was performed using descriptive statistics, including frequencies, percentages, mean scores, and standard deviations.

Responses to each questionnaire item were analysed using a five-point Likert scale. The researcher subsequently interpreted the scale findings through percentage representations, as presented in Table 4, to determine the level of agreement for each item. The discussion of agreement levels focused specifically on responses categorised as moderately agree, agree, and strongly agree.

Table 4 Modified Interpretation of Respondents' Score Levels (Pratama & Risdianto, 2021)

Percentages	Category
0%-20%	Strongly Disagree
21%-40%	Disagree
41%-60%	Moderately Agree
61%-80%	Agree
81%-100%	Strongly Agree

Finding and Discussion

Analysis of Respondents' Demographic Distribution

The analysis of the respondents' demographic distribution is presented in Table 5, which includes variables such as gender, academic qualification, and length of service. The descriptive analysis based on percentages indicates that the majority of respondents were female teachers (84.00%), while male teachers accounted for 16.00% of the sample.

The survey findings also revealed that the respondents comprised preschool teachers from diverse age groups. In terms of academic qualifications, the distribution showed that the majority of respondents who completed the questionnaire were teachers holding a bachelor's degree with Honours. The data should be in range of qualified data (Chua, 2011 & 2012).

Furthermore, regarding respondents' length of service, the data distribution showed that the largest group (56.00%) had served for more than 15 years in the field of education. The distribution for this variable was also relatively varied, as the respondents included both novice teachers and those with extensive teaching experience in the education sector.

Table 5 Percentage Distribution of Respondents' Demographic Characteristics

Item	Frequency	Percentage (%)
<u>Sex</u>		
Man	8	16
Women	42	84
Total	50	100
<u>Age</u>		
21 - 25 years old	2	4
26 - 30 years old	2	4
31 - 35 years old	18	36
36 – 40 years old	20	40
Above 41 years old	8	16
Total	50	100
<u>Academic Achievements</u>		
Bachelor Degree	36	72
Master Degree	13	26
Ph.D	1	2
Total	50	100
<u>Working Experiences</u>		

Below 5 years	2	4
6 -10 years	2	4
11- 15 years	18	36
16 – 20 years	20	40
More than 21 years	8	16
Total	50	100

Needs Analysis for the Development of the Hybrid Digital Number Skills Module (BrickSmart) in Enhancing Preschool Children's Thinking Skills

A total of 30 questionnaire items were developed and distributed to preschool teachers. Section B of the questionnaire comprised an analysis of four main domains, namely: (1) Teachers' Teaching and Learning Practices in Preschool; (2) Learning Standards; (3) Materials and Modules; and (4) Proposed Needs. The distribution of questionnaire items across the four main domains is presented in Table 6 below.

Table 6 Items and Domains

No.	ITEM	Percent age (%)	Criterion
Teachers' Teaching and Learning Practices in Preschool			
1	I am able to understand and interpret the Learning Standards (SP) for the cognitive learning domain when implementing Early Mathematics teaching and learning.	100	Strongly Agree
2	I am able to deliver and teach early mathematics skills comprehensively.	100	Strongly Agree
3	I tend to focus more on procedural or mechanical teaching and learning approaches.	100	Strongly Agree
4	I allow children to engage in self-directed learning to master number skills.	96	Strongly Agree
5	I conduct teaching and learning sessions by providing thinking tools.	90	Strongly Agree
6	I understand how to implement Thinking Skills content in the KP 2026 curriculum framework.	88	Strongly Agree
7	I am able to deliver and teach thinking skills to pupils.	88	Strongly Agree
	Average	94.0	Strongly Agree
Learning Standards			
8	All my pupils are able to match objects based on (i) colour (ii) shape (iii) size.	100	Strongly Agree
9	All my pupils are able to compare quantities of object groups.	100	Strongly Agree
10	All my pupils are able to recognise and complete patterns.	100	Strongly Agree

11	All my pupils are able to create patterns based on their own creativity.	88	Strongly Agree
12	All my pupils are able to match numerals with number names.	96	Strongly Agree
13	All my pupils are able to match groups of objects with numbers.	98	Strongly Agree
14	All my pupils are able to count one-to-one sequentially.	98	Strongly Agree
15	All my pupils are able to count and write numbers from 11 to 20.	94	Strongly Agree
16	All my pupils are able to state addition or subtraction results by counting on from a given number.	96	Strongly Agree
17	All my pupils are able to write and state mathematical sentences using addition (+), subtraction (-), and equals (=) symbols.	94	Strongly Agree
	Average	96.4	Strongly Agree
Materials and Modules			
18	Learning aids provided by the Ministry of Education support teaching and learning sessions in developing thinking skills.	66	Agree
19	Learning aids provided by the Ministry of Education help pupils master number skills.	76	Agree
20	Learning aids are suitable for continuous learning	64	Agree
21	Early Mathematics modules assist in assessing pupils' number skills levels.	66	Agree
22	Existing modules are complete and sufficient for Early Mathematics teaching and learning.	68	Agree
23	Interactive digital learning support materials (e.g., quizzes and online learning activities) are systematically provided and compiled by the Ministry of Education and are accessible for pupils' self-directed learning.	62	Agree
24	Online teaching materials provided by the Ministry of Education are easily and systematically accessible for teachers and pupils.	64	Agree
	Average	66.5	Agree
Proposed Needs			
25	I require learning aids to help my pupils master number skills.	100	Strongly Agree
26	I require learning aids to help my pupils master thinking skills.	100	Strongly Agree
27	Pupils need continuous and self-directed learning support materials.	100	Strongly Agree
28	Pupils need interaction between digital learning support materials and concrete materials to	100	Strongly Agree

	strengthen meaningful exploration in Early Mathematics learning.		
29	Pupils need interactive support materials to develop creative and critical thinking skills.	100	Strongly Agree
30	I require a digital module to enhance number skills and thinking skills as continuous learning support for pupils.	100	Strongly Agree
	Average	100	Strongly Agree

The first domain comprised Items 1-7, which focused on teachers' knowledge and experience in implementing PdPc practices at the preschool level. The findings indicate that the majority of teachers effectively interpreted and implemented the preschool curriculum, with an average agreement level of 94.0%. Nevertheless, only 88% of teachers reported providing opportunities for children to develop thinking skills during PdPc using thinking tools. This suggests the relevance and necessity of developing a structured module to enhance preschool children's thinking skills.

The second domain addressed the aspect of Learning Standards and included Items 8 to 17. These items were aligned with the Learning Standards outlined in the cognitive learning domain (KF1.1 to KF2.1) for the topic of number skills, encompassing pre-number skills, number concepts, and basic mathematical operations such as addition and subtraction at the preschool level in the KP 2026. The analysis of findings for this domain revealed that several Learning Standards did not achieve maximum agreement levels (100%). Among the Learning Standards that did not reach maximum achievement were the ability to create patterns based on individual creativity (88%), matching numerals with number names (96%), counting and writing numbers from 11 to 20 (94%), stating addition or subtraction results by counting on from a given number (94%), and the ability to write and express mathematical sentences using addition (+), subtraction (-), and equals (=) symbols.

Based on these findings, there are observable gaps that require improvement to achieve maximum mastery levels for the Learning Standards specified under KF1.1 to KF2.1. Therefore, there is a clear need to develop a hybrid digital number of skills modules to enhance preschool children's mastery of number skills. The researcher also examined teachers' knowledge and perceptions of the materials and modules domain. On average, 62% of preschool teachers reported that the Ministry of Education's learning support materials were suitable for continuous learning and incorporated elements of technology integration. A substantial proportion of teachers (66.5%) also suggested that existing materials and modules were insufficient for achieving objectives related to functioning as thinking tools, as reflected in Items 18-24.

These findings highlight that constraints associated with the effectiveness of existing learning materials in supporting continuous learning should be given attention by the Ministry of Education. Thus, it can be concluded that there is a need to develop a specialised module as a learning resource for preschool children to enhance both number skills and thinking skills.

Furthermore, the analysis of the survey findings demonstrated that teachers perceived the proposed development of the Hybrid Digital BrickSmart Module as a positive initiative in preschool education. This is evident from the findings in Items 25 to 30, which showed a 100%

unanimous agreement across all items in the questionnaire. These positive findings indicate a very high level of need within the proposed domain of needs and recommendations for the development of the Hybrid Digital BrickSmart Module to enhance number and thinking skills among preschool pupils in Malaysia.

Conclusion

The validation results for the research instrument confirmed that the developed questionnaire demonstrated high content validity. This is crucial to ensure that the data collected during the needs analysis phase accurately reflects the actual needs of teachers in the context of PdPc number skills and thinking skills at the preschool level. The evaluation and findings from the Phase 1 needs analysis further strengthened the foundation for the development of the BrickSmart Module, which will be implemented in the subsequent phase of the study. These two essential competencies—number skills and thinking skills—serve as the fundamental basis for the design and development of the hybrid digital module in Phase 2.

Based on the questionnaire findings discussed, the instrument used in the needs analysis phase is valid in terms of content and appropriate for identifying teachers' needs in developing the Hybrid Digital Number Skills Module (BrickSmart). The validation process and Phase 1 findings provide a critical foundation for ensuring the accuracy and relevance of the module design to be developed in the next phase.

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