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Development of Numeracy Skills Assessment Scale (NuSAS)

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Abstract. The study aims at creating a scale for the evaluation tool, testing the proposed categories and content validity of its domains. The construct is based on a theoretical framework that integrates early mathematics skill development in early childhood education and is applied in public elementary schools located in Congressional District 5 of Quezon City. The content validity was evaluated by five experts in the related area or field. Researchers used Lawshe's test called Content validity ratio (CVR), Kappa statistics, and Content validity index (CVI) to ascertain content validity. These were developed by the researchers into three categories with fifty items each which are Numeracy skills, Spatial thinking ability, Mathematical thinking and reasoning skills. The I-CVI of this instrument ranged from 0.2 to 1 while at end S-CVI/Ave ranged from 0.824 to 0.932 meaning it had high content validity. This research can be of great significance as it bridges the theory-practice gap in early childhood education through grounded instrument development encompassing well-defined content domains, thus improving future investigations towards enhancing reliability and validity of the scales used.

Keywords: numeracy skills, spatial thinking skills, mathematical thinking and reasoning skills early childhood education, scale, variable

Introduction

Early development of cognitive abilities in young children necessitates their acquisition of numeracy skills as this will inform the need to create a numeracy assessment scale in early childhood for all round child growth. Numerical, spatial thinking and mathematical reasoning skills are the very building blocks that help shape children's cognitive abilities and academic performance.

Utilizing and understanding numbers are fundamental units of mathematics which requires the application of numerical skills. According to Uttal et al. (2020), performance in various fields are crucially supported by spatial thinking skills and these are associated with mathematical abilities. Teaching spatial concepts in early childhood serves as foundational skills in mathematics (Pritulsky et al., 2020). Additionally, when children participate in spatial activities during their early years it would benefit them in adolescence (Peterson et al., 2020). Mathematical thinking and reasoning skills require logical reasoning as well as problem solving. Children's numeracy skills and opportunities can be influenced based on teacher's perception towards mathematics as stated by Johnston & Bull (2021). Moreover, it is said that mathematics and higher-order thinking abilities are interrelated, which highlights the importance of including mathematical concepts to our today's early childhood education according to Pollarolo et al., (2023).

Necessary skills during the formative years should be evaluated during the formative years since it is vital in recognizing and identifying areas where children may need further

support and intervention. Teachers may need more guidance in teaching spatial and orientation skills for a structured assessment scale to be successful (Koç & KOÇ, 2023). Investigating numerical skills, spatial thinking skills, and mathematical reasoning in early childhood is said to be essential for their influence on the development holistically of a child. Training the child's spatial skills during early childhood can be functional in enhancing their spatial abilities according to Yang et al. (2020). Additionally, through inquiry-based mathematics activities, children's geometric and spatial thinking skills can be improved (Korkmaz & Yilmaz, 2022).

Novanti et al. (2021) stated that logical-mathematics is important to a child's early years development because of how it is related to counting, classification, and systematic thinking. Relevant studies also suggest and highlight the significance of early childhood teachers' viewpoint on mathematics for children from birth to 5 years of age (Johnson & Bull, 2021). Further, in order to build a solid foundation for problem-solving skills, providing learning activities related to critical and creative thinking must start in early childhood as it is a crucial period for children's learning and development (Ambarini et al., 2019).

Tallud and Caballes (2023) developed the Makati Localized Numeracy Assessment Tool which aims to bridge the numeracy gap among the learners in Jose Magsaysay Elementary School. Five numeracy skills were being evaluated by this tool. Numbers, geometry, statistics, algebra, and measurement were the various components it covers. Further, the Philippine Department of Education implemented Deped Order No. 55 s. 2016 to improve mathematical competence of Filipino students (Department of Education, Philippines, 2024).

The Department of Education has reported scientific literacy inconsistencies in the National Capital Region (NCR) and leading regions include 7 and 11. Despite this, only four regions have surpassed the national average, mainly Region 4A, Region 7, NCR, and CAR (Department of Education, Philippines, 2024). Teach Starter (2024), offers a Numeracy Assessment Tool for Grade 5 pupils that covers fundamental math concepts as supplementary efforts. Importance of early numeracy development and assessment in the Philippines were emphasized by these resources.

In conclusion, review and investigation is important with regards to early childhood numerical, spatial, and mathematical skills in order to understand the course of development of these skills as well as its influence on a child's cognitive abilities. Educators and researchers may contribute to building a sturdy foundation for children's future academic success and growth by further investigations and research. These studies emphasize the need for valid and empirically tailored assessment instruments, specifically about numeracy, as well as lay out insights into the assessment and development of numeracy skills among early childhood learners in the Philippines.

Stage 1: Instrument Development

As stated by Zamanzadeh et al., the instrument creation first stage is made up of three stages: identifying the content domain, producing sample items, and constructing the instrument. Therefore, the respondents or specialized groups are approached with reference to the content

domain. In order to arrive at consensus on the definition of the construct and some items for the beginning phase, we use the following technique (Figure 1).

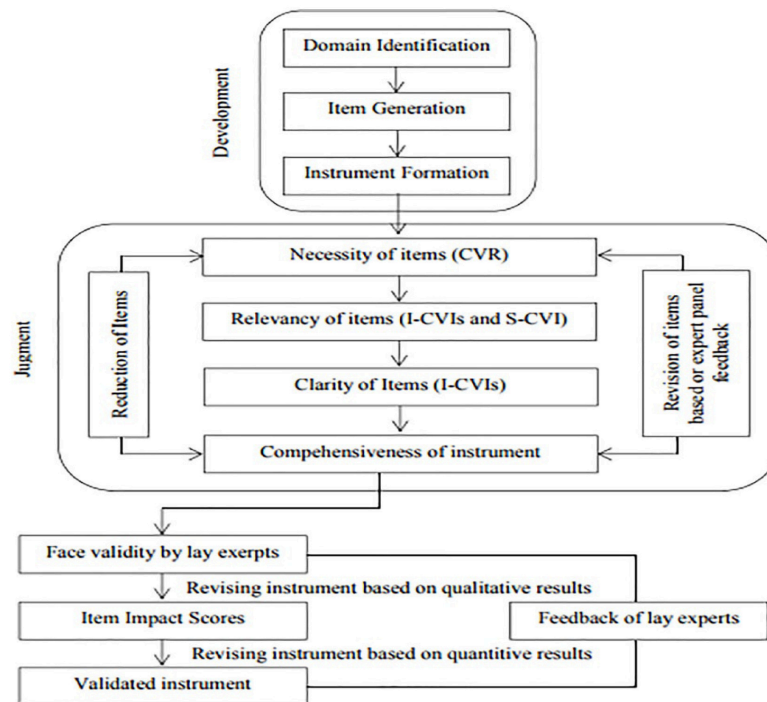


Figure 1. Steps as a guide in content validity.

The researchers chose the topic field for making a Numeracy Skills Assessment Scale after going through many books on the issue. Literature review shows that there are research gaps in terms of the basis of the construct. The investigation brought to light a clear lack of conceptual clarity among various definitions of numeracy abilities, which sadly contradict each other. There was an apparent contrast between academic and theoretical views about students' numeracy skills. It was therefore important to involve practitioners and academicians in developing this idea to bridge this gap in research. For this purpose, the researchers selected 5 Licensed Professional Teachers with a Bachelor and Masters degree from any of the following: Bachelor of Science in Applied Mathematics (BSAM), Bachelor of Arts in Mathematics (BAM), and Bachelor of Science in Mathematics (BSM). The researchers coordinate with the Quezon City Division Office of the Department of Education to conduct a study on the public elementary schools of Congressional District V of Quezon City . 5 experts from different public elementary schools agreed to participate for researchers' instrument validation. Instruments were validated with them for 45 mins to 1 hour using structured numeracy skills assessment scale for time and dates depending on their different availability inside their respective schools. All the validations were verified and transcribed, data were collected for 2 months from March to May 2024.

In order to construct a comprehensive understanding of the initial progression of mathematical proficiency within early childhood education, this study embraced Parviainen's (2019) theoretical framework. Transcribed data underwent coding for consolidation into distinct construct dimensions. Through preliminary, focused, and theoretical coding methods, researchers delineated three primary categories of early mathematical skills: numerical skills, spatial cognition, and mathematical thinking and reasoning abilities, as illustrated in Figure 2. These three steps were responsible for reducing 24 original codes to 13 theme clusters. Finally, typologies created after clustering themes were divided into the following three categories of early mathematical skills (Table 1). Explaining how these products are developed as well as how the theoretical framework is used will go beyond explaining the study.

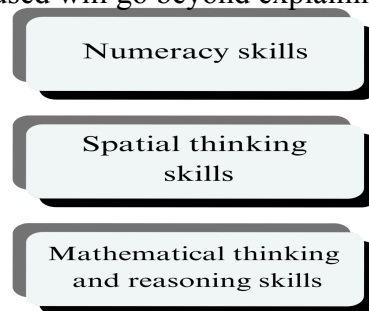
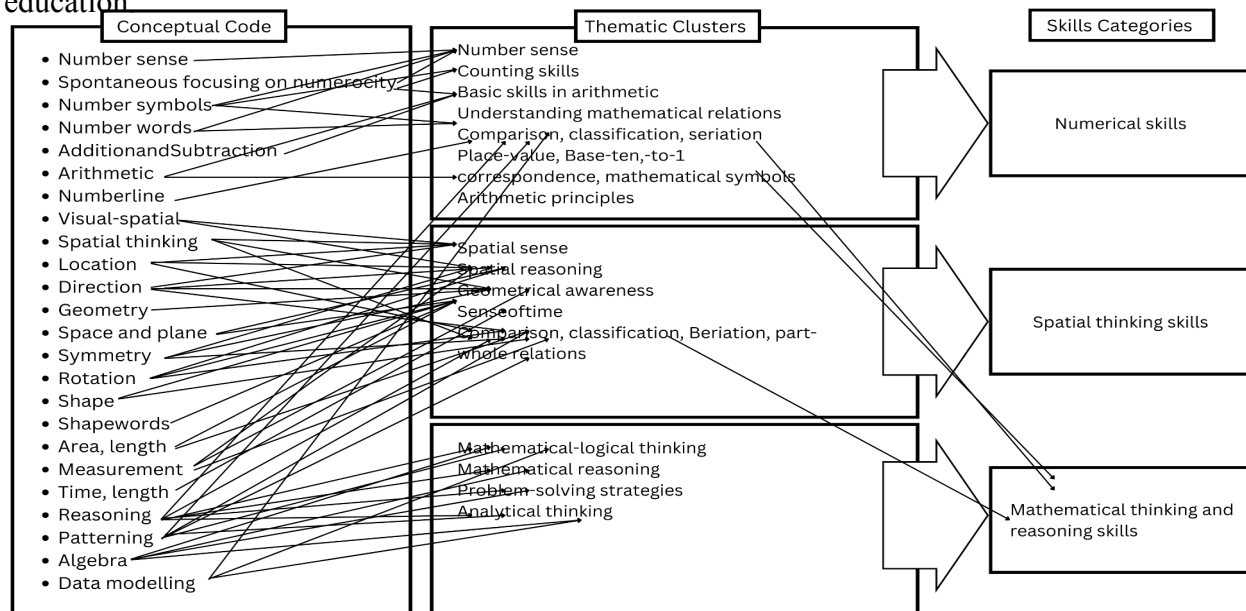


Figure 2. Early mathematical skills categories through an all-encompassing blueprint for nurturing the growth of foundational mathematical abilities during the early stages of childhood education



Stage 2: Judgement

The second stage of judging a certain number of experts should validate the items. For ensuring that the content validity of the evaluation instrument is maintained. One should choose

domain expertise based on such factors as specialized training, professional experience, or expert understanding of the subject matter. Specifically for assessing content validity, the recommendation is that a minimum of five specialists should be involved. However, there is no definite maximum number of experts. It is doubtful that possibly more than ten experts will be involved in the process because it decreases the likelihood of expert consensus (Polit and Beck, 2006). The researchers, therefore, selected five domain experts; two Teacher 3s and three Master Teachers who were experienced in mathematics and in the broader field of education for the purpose of assessing content validity for item generation (Table 2).

Table 2. The Subject Matter Experts (SMEs) that are Selected for Judging the Content Validity.

Designation of domain experts	School	Years of experience
1. Grade School Teacher	MT (Math), Goodwill ES	18
2. Grade School Teacher	T3 (Math), Bagbag ES	10
3. Grade School Teacher	T3 (Math), Rosa L. Susano ES	12
4. Grade School Teacher	MT (Math), Nagkaisang Nayon ES	20
5. Grade School Teacher	MT (Math), Kaligayahan ES	21

Note. MT=Master Teacher; T3= Teacher 3; ES= Elementary School

The panel of experts was asked to give their subjective, personal views on each piece in the early math skills area. To make sure the items made were truly valid, feedback on how fitting, needed, typical, and complete they were was collected from both detailed and number-based views. The views of the experts were checked using CVI, Kappa numbers, and CVR computation.

Quantification of Content Validity

CVI

The Content Validity Index was computed for the entire scale (S-CVI) as well as for individual items (I-CVI). Expert panel members were consulted for the elements on the Numeracy Assessment Scale. Experts were asked to rank each component according to how relevant it was to the build. Every single item went through a rating process based on a scale that had four points; this scale had four marks which were one for nothing relevant, two a little bit relevant, three moderately relevant, and four as extremely important

The I-CVI was calculated on the basis of experts whose endorsements were three or four with respect to the common value of expertise's group in general. I-CVI must be 1.00 for 5 or less experts, for 6 or more experts, the I-CVI should not be less than 0.79. On the other hand, the whole scale Content Validity Index (S-CVI) was calculated by getting the average CVI of all the items. According to Lynn (1986) which was backed up by Polit & Beck (2006), S-CVI can be

interpreted in two options, the Universal Agreement and Average which reflects the item percentage receiving 3 or 4 ratings from the experts, and emphasizes the average item quality respectively.

Kappa Statistic Coefficient

CVI is widely used by researchers to evaluate content validity. However, it doesn't account for the inflated numbers that could surface as a result of the likelihood of coincidental agreement. A better understanding of content validity is ensured by the computation of the Kappa coefficient, which removes any chance agreement. In order to ensure that expert agreement is not the product of chance, the Kappa statistic is added to CVI. The formula $P_c = \frac{A!}{[N!] \times 0.5N}$, where A is the number of panel experts who deemed the item important and N is the total number of panel experts. On the other hand, the Kappa statistic is then calculated using the formula $K = (I-CVI - P_c) / (1 - P_c)$. Polit & Beck (2006) and Zamanzadeh et al. (2014) stated that if the Kappa Statistic Coefficient values measured more than 0.74, it is considered to be excellent, if the values fall between 0.60 and 0.74 it is considered good, and values 0.40 to 0.59 is considered to be fair.

CVR

According to Lawshe (1975), the CVR defines whether an item should be accepted or rejected from a construct. Each expert rated it as 1) essential, 2) beneficial however not essential, 3) non-necessary. N_d is the total number of experts who classified an item as “essential while as N_e is the total number of experts.” The formula to calculate the CVR of each item is $CVR = (N_e - N / 2) / (N - 2)$. High and positive CVR scores indicate that, according to the Ayre & Scally (2014) study, experts concur on the necessity of a particular item in the measure. Schipper estimated the critical values for the CVR in many methods, and they range from 0.29 to 0.99 (Wilson, Pan, & Schumsky, 2012).

Results

The grade 3 children's numeracy domain, spatial skills, and mathematical and reasoning thinking I-CVI is 0.824, 0.932, and 0.892 respectively (Table 4), (Table 3), and (Table 5). I-CVI for each item within the three grouping ranged from 0.2 to 1. The sum of the I-CVI of all the items on the scale is 44 implying that the scale has good content validity for the concept of numeracy abilities which requires an S-CVI of at least 0.8. Items with an I-CVI of between 0.2 to 0.66 require revision. The majority of items had kappa values ranging from 0.76–1. Eighteen were in dispute by the raters as reflected by lower than 0.76 kappa values and therefore these could not be entirely included in the construct of numeracy abilities.

Table 3. Ratings on 50-item Scale for “Numeracy Skills” Category of Early Mathematical Skills in Early Childhood Education by Five-Experts: Items Rated 3 or 4 on a 4-Point Relevant Scale.

Category: Numeracy Skills

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	No. in agreement	I-CVI	PC	Kappa Statistics
1	3	3	3	3	3	5	1	0.31	1
2	4	4	3	3	3	5	1	0.31	1
3	4	4	4	4	4	5	1	0.31	1
4	2	4	3	1	1	2	0.4	0.31	0.127
5	3	3	4	3	4	5	1	0.31	1
6	4	4	3	3	3	5	1	0.31	1
7	3	3	3	3	3	5	1	0.31	1
8	2	3	4	3	4	4	0.8	0.156	0.76
9	1	2	3	2	2	1	0.2	0.156	0.051
10	3	3	3	3	3	5	1	0.31	1
11	3	4	4	4	3	5	1	0.31	1
12	4	4	4	4	4	5	1	0.31	1
13	3	3	3	3	3	5	1	0.31	1
14	3	4	4	3	3	5	1	0.31	1
15	3	3	3	3	3	5	1	0.31	1
16	4	3	3	4	3	5	1	0.31	1
17	3	3	3	4	4	5	1	0.31	1
18	3	3	4	4	4	5	1	0.31	1
19	2	3	3	3	2	3	0.6	0.31	0.418
20	3	3	3	3	3	5	1	0.31	1
21	4	3	4	3	3	5	1	0.31	1
22	4	4	4	4	4	5	1	0.31	1
23	3	4	3	4	3	5	1	0.31	1
24	4	4	4	4	3	5	1	0.31	1
25	2	3	3	3	3	4	0.8	0.156	0.76
26	3	4	4	4	4	5	1	0.31	1
27	4	4	4	4	4	5	1	0.31	1
28	3	4	3	4	3	5	1	0.31	1
29	3	3	3	4	4	5	1	0.31	1
30	3	3	3	3	3	5	1	0.31	1
31	4	3	3	4	3	5	1	0.31	1
32	3	3	3	4	4	5	1	0.31	1
33	3	3	4	4	4	5	1	0.31	1
34	2	3	3	3	2	3	0.6	0.31	0.418
35	3	3	3	3	3	5	1	0.31	1
36	4	3	4	3	3	5	1	0.31	1
37	4	4	4	4	4	5	1	0.31	1
38	3	4	3	4	3	5	1	0.31	1
39	4	4	4	4	3	5	1	0.31	1
40	2	3	3	3	3	4	0.8	0.156	0.76
41	3	4	4	4	4	5	1	0.31	1
42	4	4	4	4	4	5	1	0.31	1
43	3	4	3	4	3	5	1	0.31	1
44	3	3	3	4	4	5	1	0.31	1
45	3	3	3	3	3	5	1	0.31	1
46	4	4	3	3	3	5	1	0.31	1
47	4	4	4	4	4	5	1	0.31	1
48	2	4	3	1	1	2	0.4	0.31	0.127
49	3	3	4	3	4	5	1	0.31	1
50	3	3	3	3	3	5	1	0.31	1

Note. S-CVI (0.932) = (accepted). I-CVI = item content validity index; Pc = probability of

Table 4. Ratings on 50-item Scale for “Spatial Thinking Skills” Category of Early Mathematical Skills in Early Childhood Education by Five-Experts: Items Rated 3 or 4 on a 4-Point Relevant Scale.

Category: Spatial Thinking Skills

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	No. in agreement	I-CVI	PC	Kappa Statistics
1	2	4	4	4	3	4	0.8	0.156	0.76
2	4	2	4	4	4	4	0.8	0.156	0.76
3	4	4	4	3	4	5	1	0.31	1
4	4	4	3	3	3	5	1	0.31	1
5	3	4	4	4	3	5	1	0.31	1
6	3	4	3	2	4	4	0.8	0.156	0.76
7	4	4	4	3	4	5	1	0.31	1
8	2	4	3	4	4	4	0.8	0.156	0.76
9	3	1	1	2	4	2	0.4	0.31	0.127
10	4	3	2	2	4	4	0.8	0.156	0.76
11	3	3	3	4	4	5	1	0.31	1
12	4	2	4	3	1	5	1	0.31	1
13	3	4	4	4	1	4	0.8	0.156	0.76
14	2	1	3	4	4	3	0.6	0.31	0.418
15	4	4	4	3	4	5	1	0.31	1
16	4	4	4	3	4	5	1	0.31	1
17	4	4	3	3	3	5	1	0.31	1
18	3	4	4	4	3	5	1	0.31	1
19	3	4	3	2	4	4	0.8	0.156	0.76
20	4	4	4	3	4	5	1	0.31	1
21	2	4	3	3	3	4	0.8	0.156	0.76
22	4	4	4	4	1	4	0.8	0.156	0.76
23	2	1	3	2	2	1	0.2	0.156	0.051
24	4	4	4	3	4	5	1	0.31	1
25	2	2	3	3	4	3	0.6	0.31	0.418
26	3	4	4	4	2	4	0.8	0.156	0.76
27	3	4	4	4	1	4	0.8	0.156	0.76
28	3	4	3	2	4	4	0.8	0.156	0.76
29	4	3	2	4	4	4	0.8	0.156	0.76
30	2	3	3	4	4	4	0.8	0.156	0.76
31	4	4	4	3	4	5	1	0.31	1
32	4	4	4	4	4	5	1	0.31	1
33	4	3	4	3	1	4	0.8	0.156	0.76
34	3	4	2	4	2	3	0.6	0.31	0.418
35	4	4	3	3	3	5	1	0.31	1
36	3	4	4	4	2	4	0.8	0.156	0.76
37	3	4	4	4	1	4	0.8	0.156	0.76
38	2	3	3	4	4	4	0.8	0.156	0.76
39	4	4	4	3	4	5	1	0.31	1
40	4	4	4	4	4	5	1	0.31	1
41	2	3	2	2	1	1	0.2	0.156	0.051
42	3	4	2	4	4	4	0.8	0.156	0.76
43	4	4	3	3	3	5	1	0.31	1
44	4	4	2	2	1	2	0.4	0.31	0.127
45	4	4	4	4	4	5	1	0.31	1
46	2	4	3	3	4	4	0.8	0.156	0.76
47	3	4	4	4	2	4	0.8	0.156	0.76
48	3	4	4	4	1	4	0.8	0.156	0.76
49	2	1	3	4	4	3	0.6	0.31	0.418
50	4	4	4	3	4	5	1	0.31	1

Note. S-CVI (0.824) = (accepted). I-CVI = item content validity index; Pc = probability of chance agreement; S-CVI = scale content validity index.

Table 5. Ratings on 50-item Scale for “Mathematical Thinking Skills” Category of Early Mathematical Skills in Early Childhood Education by Five-Experts: Items Rated 3 or 4 on a 4-Point Relevant Scale.

Category: Mathematical Thinking and Reasoning Skills

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	No. in agreement	I-CVI	PC	Kappa Statistics
1	3	4	3	4	4	5	1	1	0.76
2	4	3	2	4	4	4	0.8	0.76	0.76
3	4	1	3	4	4	4	0.8	0.76	1
4	3	3	3	4	3	5	1	1	1
5	3	4	4	3	3	5	1	1	1
6	4	4	4	4	3	5	1	1	0.76
7	1	3	3	4	4	4	0.8	0.76	1
8	2	4	3	4	2	3	0.6	0.41	0.76
9	4	4	3	4	4	4	0.8	0.76	0.127
10	3	4	3	2	4	4	0.8	0.76	0.76
11	2	3	4	3	4	4	0.8	0.76	1
12	4	3	3	3	4	5	1	1	1
13	3	3	3	3	3	5	1	1	0.76
14	3	4	4	3	4	5	1	1	0.418
15	4	4	3	3	3	5	1	1	1
16	3	3	4	2	4	4	0.8	0.76	1
17	4	4	4	4	4	5	1	1	1
18	4	3	4	3	4	5	1	1	1
19	3	4	3	3	3	5	1	1	0.76
20	4	3	2	4	2	3	0.6	0.41	1
21	4	1	3	4	4	4	0.8	0.76	0.76
22	3	3	3	4	3	5	1	1	0.76
23	3	4	4	3	3	5	1	1	0.051
24	4	4	4	4	3	5	1	1	1
25	3	4	3	2	4	4	0.8	0.76	0.418
26	2	3	4	3	4	4	0.8	0.76	0.76
27	4	3	3	2	4	4	0.8	0.76	0.76
28	3	3	3	3	3	5	1	1	0.76
29	3	4	4	3	4	5	1	1	0.76
30	4	4	3	3	3	5	1	1	0.76
31	3	3	4	2	4	4	0.8	0.76	1
32	4	4	4	4	4	5	1	1	1
33	4	3	4	3	4	5	1	1	0.76
34	3	4	3	3	3	5	1	1	0.418
35	2	4	4	3	4	4	0.8	0.76	1
36	3	4	3	4	4	5	1	1	0.76
37	4	3	2	4	4	4	0.8	0.76	0.76
38	4	1	3	2	4	3	0.6	0.41	0.76
39	3	3	3	4	3	5	1	1	1
40	3	4	4	3	3	5	1	1	1
41	4	4	4	4	3	5	1	1	0.051
42	1	3	3	4	4	4	0.8	0.76	0.76
43	2	4	3	4	2	3	0.6	0.41	1
44	4	4	3	4	4	5	1	1	0.127
45	4	3	4	3	4	5	1	1	1
46	3	4	3	3	3	5	1	1	0.76
47	2	4	4	3	4	4	0.8	0.76	0.76
48	3	4	3	4	4	5	1	1	0.76
49	4	3	2	4	2	3	0.6	0.41	0.418
50	4	1	3	4	4	4	0.8	0.76	1

Note. S-CVI (0.892) = (accepted). I-CVI = item content validity index; Pc = probability of chance agreement; S-CVI = scale content validity index.

Table 6. CVR for items Scale of Each Category of Early Mathematical Skills in Early Childhood Education Where Ne Represents the Number of Experts Who Rate an Item as “Essential”.

Numerical Skills			Spatial Thinking Skills			Mathematical Thinking Skills		
Item	Ne	CVR	Item	Ne	CVR	Item	Ne	CVR
1	5	1	1	4	0.6	1	5	1
2	5	1	2	4	0.6	2	4	0.6
3	5	1	3	5	1	3	4	0.6
4	2	-0.2	4	5	1	4	5	1
5	5	1	5	5	1	5	5	1
6	5	1	6	4	0.6	6	5	1
7	5	1	7	5	1	7	4	0.6
8	4	0.6	8	4	0.6	8	3	0.2
9	1	-0.6	9	2	-0.2	9	4	0.6
10	5	1	10	4	0.6	10	4	0.6
11	5	1	11	5	1	11	4	0.6
12	5	1	12	5	1	12	5	1
13	5	1	13	4	0.6	13	5	1
14	5	1	14	3	0.2	14	5	1
15	5	1	15	5	1	15	5	1
16	5	1	16	5	1	16	4	0.6
17	5	1	17	5	1	17	5	1
18	5	1	18	5	1	18	5	1
19	3	0.2	19	4	0.6	19	5	1
20	5	1	20	5	1	20	3	0.2
21	5	1	21	4	0.6	21	4	0.6
22	5	1	22	4	0.6	22	5	1
23	5	1	23	1	-0.6	23	5	1
24	5	1	24	5	1	24	5	1
25	4	0.6	25	3	0.2	25	4	0.6
26	5	1	26	4	0.6	26	4	0.6
27	5	1	27	4	0.6	27	4	0.6
28	5	1	28	4	0.6	28	5	1
29	5	1	29	4	0.6	29	5	1
30	5	1	30	4	0.6	30	5	1
31	5	1	31	5	1	31	4	0.6
32	5	1	32	5	1	32	5	1
33	5	1	33	4	0.6	33	5	1
34	3	0.2	34	3	0.2	34	5	1
35	5	1	35	5	1	35	4	0.6
36	5	1	36	4	0.6	36	5	1
37	5	1	37	4	0.6	37	4	0.6
38	5	1	38	4	0.6	38	3	0.2
39	5	1	39	5	1	39	5	1
40	4	0.6	40	5	1	40	5	1
41	5	1	41	1	-0.6	41	5	1
42	5	1	42	4	0.6	42	4	0.6
43	5	1	43	5	1	43	3	0.2
44	5	1	44	2	-0.2	44	5	1
45	5	1	45	5	0.6	45	5	1
46	5	1	46	4	0.6	46	5	1
47	5	1	47	4	0.6	47	4	0.6
48	2	-0.2	48	4	0.6	48	5	1
49	5	1	49	3	0.2	49	3	0.2
50	5	1	50	5	1	50	4	0.6

Note. CVR = content validity ratio.

Conclusion

The process of measuring an essential part of educational research where concepts often exist at high levels of abstraction. Content validity plays a role, in this process ensuring that the translation of concepts into elements is crafted upon the pertinent elements intertwined with the essence of the subject matter under evaluation.. When evaluating numeracy skills a measurement scale was developed using a theoretical framework by Parviainen, P. (2019) in pursuit of a comprehensive framework for nurturing the genesis of mathematical aptitude during the formative years of early childhood education. Initially 150 items were identified through a validation form by five experts. Subsequently these items were reviewed by mathematics experts for their relevance and necessity resulting in content validity as determined by CVI, Kappa. CVR.

This method aligns in educational viewpoints on assessing numeracy skills but also ensures that the development of the tool is firmly rooted in a consensus based content domain. However to strengthen the credibility and usefulness of the assessment scale future studies should focus on testing its properties, including enhancing the dependability and diverse dimensions of validity, encompassing face, construct, and criterion validity. This holistic strategy aims to elevate the efficacy and precision of the assessment tools in gauging numeracy prowess.

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